AVIATION WEEK

A McGRAW-HILL PUBLICATION

September 2, 1957 50 cents

Helicopters Lick Terrain in Hunt For Oil Fields

Sud Aviation Baroudeur

E B POWER
UNIVERSITY MICROFILM INC
313 N 1ST ST
ANN ARBOR MICH

he's watching the progress of the Air Age from his machine...

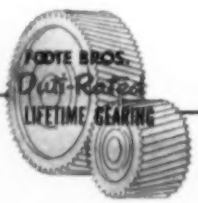
Piston engines . . . jets . . . and now, missiles, Foote Bros. craftsmen are watching the steady advance of American air progress from their machines. They're not only watching it—they are an important part of it, because, at this moment they are helping produce components capable of performance undreamed of a short time ago.

At Foote Bros., yesterday's technology, methods and standards of precision are obsolete. Today, these men are working with new metals in new ways, with greater precision, to produce lighter, stronger and more reliable gearing, power transmission and actuating mechanisms for the air age of tomorrow.

It is the willingness to innovate, the ability to anticipate, and the determination to excel that have helped Foote Bros. engineers and production men keep pace with, and earn the confidence of, the aviation industry.

We may be able to help solve your problems involving precision gearing and actuating mechanisms, and would welcome the opportunity of talking with you.

this trademark stands for the finest industrial gearing made



FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION

4545 South Western Boulevard, Chicago 9, Illinois

"Go-Anywhere" tires–

and fuel you can "Roll With You"

Two Interesting and Downright Practical Examples of Engineering Ingenuity by the Goodyear Aviation Products Division

How many ways can you see to utilize these Goodyear advancements in your operation?

Take the Terra-Tire—the "go-anywhere" tire developed by Goodyear engineers. Now to be put in service with Missile Squadrons, making possible greatly increased mobility and simplified logistics, these huge tires are able to traverse "impassable" terrain. Low inflation pressure and wide footpad are the keys to Terra-Tire performance.

Planes equipped with the Terra-Tire can land on unimproved fields. The Terra-Tire can be axle-driven, gives heavy vehicles new flotation and traction over marshy and sandy ground.

And look at the Rolli-Tanker—the rolling "tanker"! Filled with fuels or other liquid, it can follow wherever you roll, be towed in tandem by your prime mover without increasing your vehicle's axle loading, be air-dropped by chute, floated ashore.

To the names Terra-Tire and Rolli-Tanker add Iceguard, Pliocel, Air Mat and a host of others—all products of the engineering ingenuity of Goodyear Aviation Products. For information on any of them, and the skills and facilities which make them possible – write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

GOODYEAR AVIATION PRODUCTS

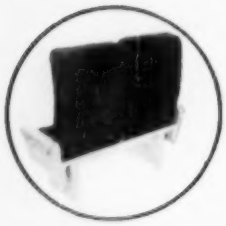
Terra-Tire, Rolli-Tanker, Iceguard, Pliocel
–T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

the world's largest manufacturing facility for aircraft seating ... for aircraft interior equipment

the T-34* seat

low cost
low weight
low maintenance
high comfort

Quantity Prices even on Small Orders



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a World of experience in: Pilot and crew seats, ejection seats, passenger seats, buffets and lavatory units.

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AVIATION CALENDAR

Aug. 31-Sept. 1—Midget airplane Races, Ft. Wayne, Ind.

Sept. 1-15—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Sept. 3-14—11th General Assembly, International Union of Geodesy and Geophysics, in conjunction with International Geophysical Year, University of Toronto, Canada.

Sept. 7—Second Annual Convention of the OX-5 Club, Hotel Phillips, Kansas City, Mo.

Sept. 8-13—Second Annual Course on Investment Castings, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 9-11—15th Annual Meeting, Electron Microscope Society of America, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 9-13—Twelfth Annual Instrument-Automation Conference, and Exhibit, Cleveland Auditorium, Cleveland, Ohio.

Sept. 10-11—First Regional Business Aircraft Safety Seminar, Jack Tar Hotel, Galveston, Tex.

Sept. 13—Summer Space Flight Meeting, American Astronautical Society, Roosevelt Memorial Hall, American Museum of Natural History, Central Park West & 79th St., N. Y., N. Y.

Sept. 13—Third Pacific Area National Meeting, American Society for Testing Materials, Sheraton-Palace Hotel, San Francisco, Calif.

Sept. 14-15—Meeting of Antique Airplane Assn., Ottumwa, Ia.

Sept. 15—1957 Garden Party and Flying Display, Royal Aeronautical Society, Wisley Aerodrome, Weybridge, England.

Sept. 19-20—Business Aircraft Operations Symposium & Eighth Annual P&WA Air-work Engine Operation and Maintenance Forum, Millville Airport, N. J.

Sept. 21—Third Annual Helicopter Air Dis-

(Continued on page 6)

AVIATION WEEK • SEPTEMBER 2, 1957

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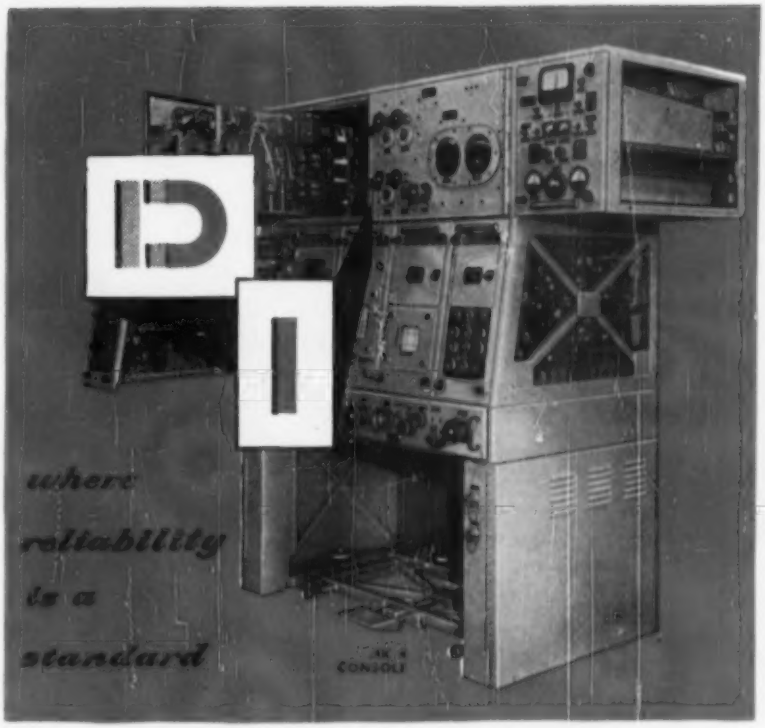

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Electronic, mechanical and electro-mechanical products, manufactured at Daystrom Instrument to critical customer specifications are shipped daily to the Armed Services and industry.

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Our production includes fire control systems, communication systems, test equipment, attack directors, underwater ordnance, power supplies, electronic chassis, radar, gear assemblies, aircraft instrumentation and a host of other products.

Let Daystrom Instrument assist you in meeting your product needs. One of our sales engineers is ready to discuss our qualifications with you. Write us, and he will call at your convenience.

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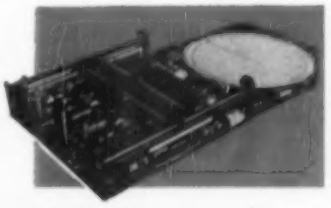
PILOT'S DEAD RECKONING INDICATOR

JUST OFF THE PRESS: Our New Facilities Brochure. Write for it!

DAYSTROM INSTRUMENT
Archbald, Pennsylvania
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New **VAN TRAILER** by Craig
houses all this equipment . . . with room to spare!

There's plenty of room inside the new insulated Craig Van Trailer LM-105! With its big 5,000 pound payload and roomy 575 cubic foot interior, this rugged van trailer can house 12 standard 6-foot racks, fully loaded with electronic equipment — and still allow ample space for operation and maintenance.

Whatever the load — a complete electronic system, test equipment, mobile maintenance shop, or you-name it — your equipment arrives quickly and safely in the LM-105. This versatile van trailer meets Government specifications for world-wide, all-weather use.

Quick facts about the LM-105:

WEIGHT: Approximately 4,000 pounds including dolly.

PAYLOAD: 5,000 pounds.

DIMENSIONS: (Inside) 140 inches long, 90 inches wide, 79 inches high.

INSULATION: overall shelter has U-Factor of 0.30.

FEATURES INCLUDE: aluminum-faced honeycomb panel construction; lighting system; power distribution box; cable entry ports; stairs; jacks for levelling; and a quickly detachable dolly with coil spring and torsion bar suspension, air-over-hydraulic brakes, and single beam towing tongue.

ACCESSORY EQUIPMENT AVAILABLE: includes air conditioner, heater, workbench, racks, cabinets, spare parts containers, etc.

AIR TRANSPORTABLE: By C-119 or larger cargo aircraft.

ELECTRONIC INSTALLATION: Craig provides complete layout and installation of equipment including wiring and component check-out.

Van Trailer LM-105, front view, with jacks in position.

For further information, write Craig today!

Craig SYSTEMS, INC. *Dept. N-9, Danvers, Mass. Tel.: SPring 4-1870.*

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OTHER CRAIG PRODUCTS . . . . *transportable and mobile electronic systems, shelters, trailers, vans, mobile control towers, missile carriers, re-usable containers, antenna towers and masts.*

AVIATION CALENDAR

(*Continued from page 5*)

play, Bridgeport Municipal Airport, American Helicopter Society, New England Region, Bridgeport Municipal Airport, Conn. Rain date is Sept. 22.

Sept. 23-25—Fall Meeting American Society of Mechanical Engineers, Statler Hotel, Hartford, Conn.

Sept. 25—Pratt & Whitney Aircraft Engine Maintenance and Operation Forum, sponsored by Southwest Airmotive Co., Melrose Hotel, Dallas, Tex.

Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The Aero Club of Michigan, Alpena, Mich.

Sept. 28-29—North Central Regional Conference, Civil Air Patrol, Town House Hotel, Kansas City, Kans.

Sept. 30-Oct. 5—National Aeronautic Meeting, Aircraft Production Forum & Aircraft Engineering Display, Society of Automotive Engineers, Hotel Ambassador, Los Angeles.

Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Oct. 5—First Annual Awards Banquet Society of Experimental Test Pilots, Beverly-Hilton Hotel, Los Angeles.

Oct. 7-9—13th Annual National Electronics Conference, Chicago, Ill.

Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland.

Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barcelona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.

Oct. 8—Tenth Annual Airport Development and Operations Conference, Onondaga Hotel, Syracuse, N. Y.

Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.

Oct. 10-11—National Noise Abatement Symposium, Sherman Hotel, Chicago, Ill.

Oct. 21-22—Canadian Aeronautical Institute-Institute of the Aeronautical Sciences Meeting, Montreal, Canada.

Oct. 21-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Americus Hotel, Allentown, Pa.

Oct. 24-25—Fourteenth Annual Display, Aircraft Electrical Equipment, Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles, Calif.

Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, N. Y.

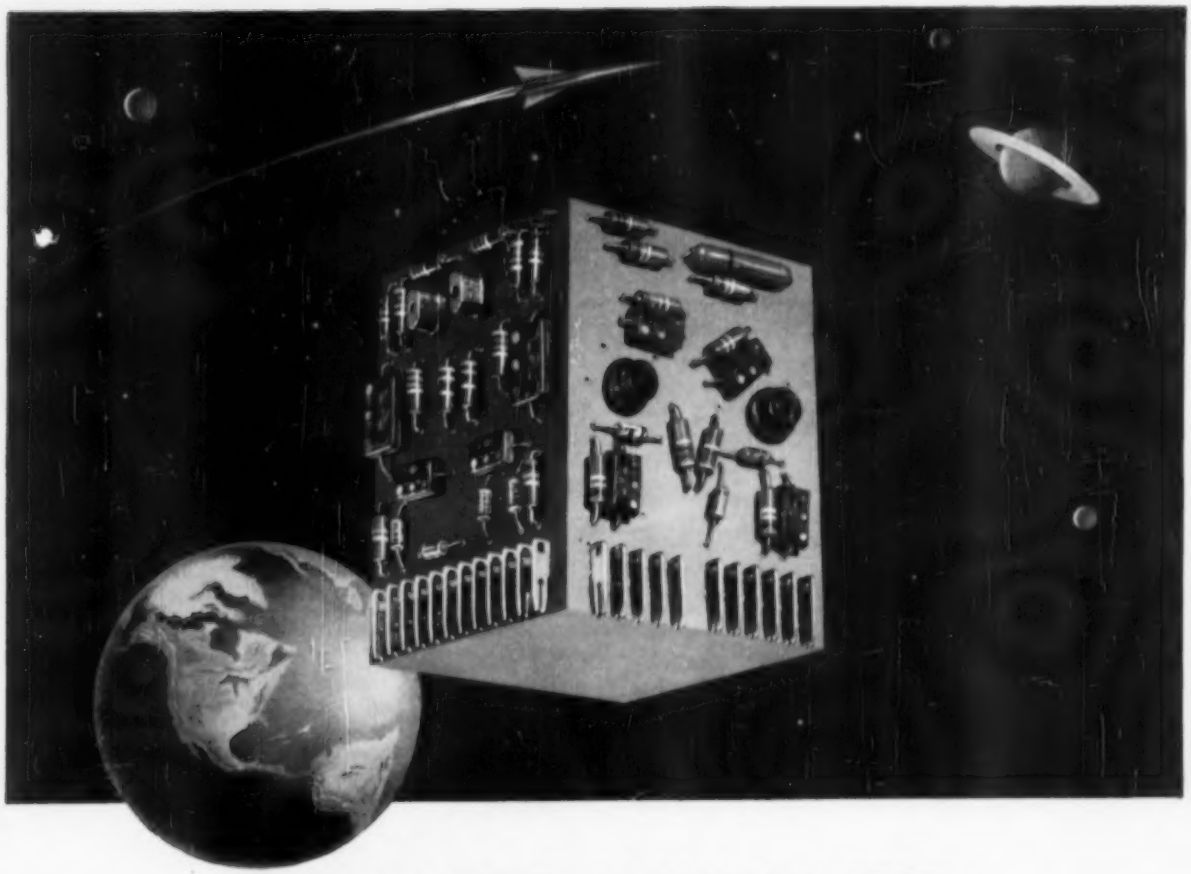
Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.

Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 30—Aviation Electrical Equipment Display, U. S. Grant Hotel, San Diego.

Nov. 5-7—Joint Military-Industry Guided Missile Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu.

Nov. 6-8—Third Annual Symposium on Aeronautical Communications, Hotel Utica, Utica, N. Y.



BOX TO CATCH A FALLING STAR...

At the speed of falling stars – and missiles – the "box" that "catches" them is an electronic tracking system that digitalizes and records a flight path in space.

Efficient and rapid data reduction is the key to tracking and monitoring supersonic and hypersonic missiles. Each piece of telemetry and position information must be transformed into digital inputs for computer analysis. And this must be done ***instantaneously*** and ***reliably.***

Cubic Corporation digital equipment, associated with the firm's tracking systems, digitalizes trajectory data from shaft angle and servo inputs and records it on magnetic tape, ready for computer entry and analysis.

Cubic equipment is fully transistorized for highest possible reliability, and is fabricated with modular plug-in components for most efficient maintenance. Five plug-in package types fulfill 95% of equipment needs, thus simplifying spare part problems.

Cubic's data handling systems can also play back taped digital records for printout on a rapid printer of the adding-machine type.

Cubic transistorized digital systems are in production for the Air Force in full compliance with military specifications.

Descriptive brochure is available upon request.

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A brand new concept in

modern day hangars...

ERWIN-NEWMAN SUSPENDED CANTILEVER HANGARS

Most revolutionary development in the last fifty years

Cantilever type construction means that no columns of any nature interrupt the clear span space. EVERY square foot of hangar space is a square foot of usable space. The support member which connects the top ridge of the cantilever to the top of the inner column is designed to act either in tension or compression and will withstand the exact load forces of any locality.

ANY HEIGHT • ANY LENGTH • ANY DEPTH

Each hangar is specifically designed for the snow and roof loads of the area in which it is erected. The space at the rear is conveniently used for workshops, parts and offices.

Night view of TEMCO AIRCRAFT CORP. hangar at Greenville, Texas. The clear span area measures 120 feet deep by 576 feet long by 30 feet high. Vertical clearance is 45 feet inside the tail housings.

TYPICAL QUOTES FROM SATISFIED USERS INCLUDE:

Mr. E. F. Buehring, Plant Manager, TEMCO AIRCRAFT CORP., says, "The cantilever type hangar constructed by your company has proved to be highly satisfactory for our aircraft overhaul and modification program."

Mr. C. F. Zimmerman, Supt. Aviation Operations, CONTINENTAL OIL CO., remarked, "It is our opinion that this hangar constructed by your firm has measured up to our expectations and fulfills all of our requirements."

Write us for free booklet or any other information you desire

THE ERWIN-NEWMAN CO.

Designers and Constructors

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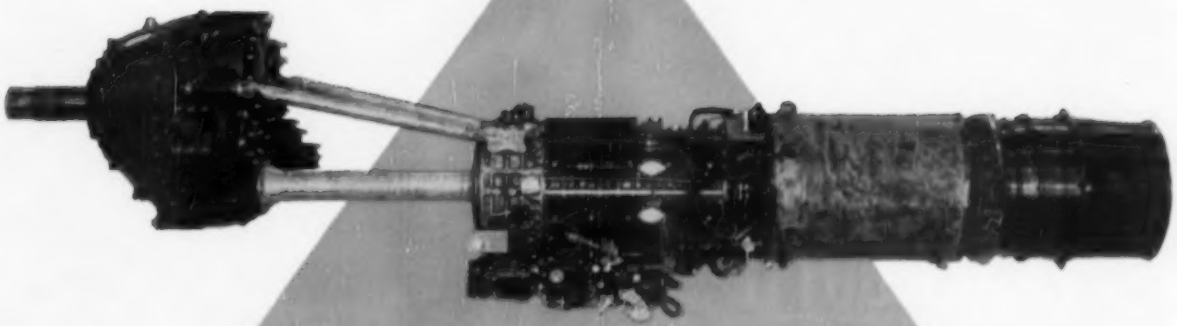
Meeting a need on time...the

T56

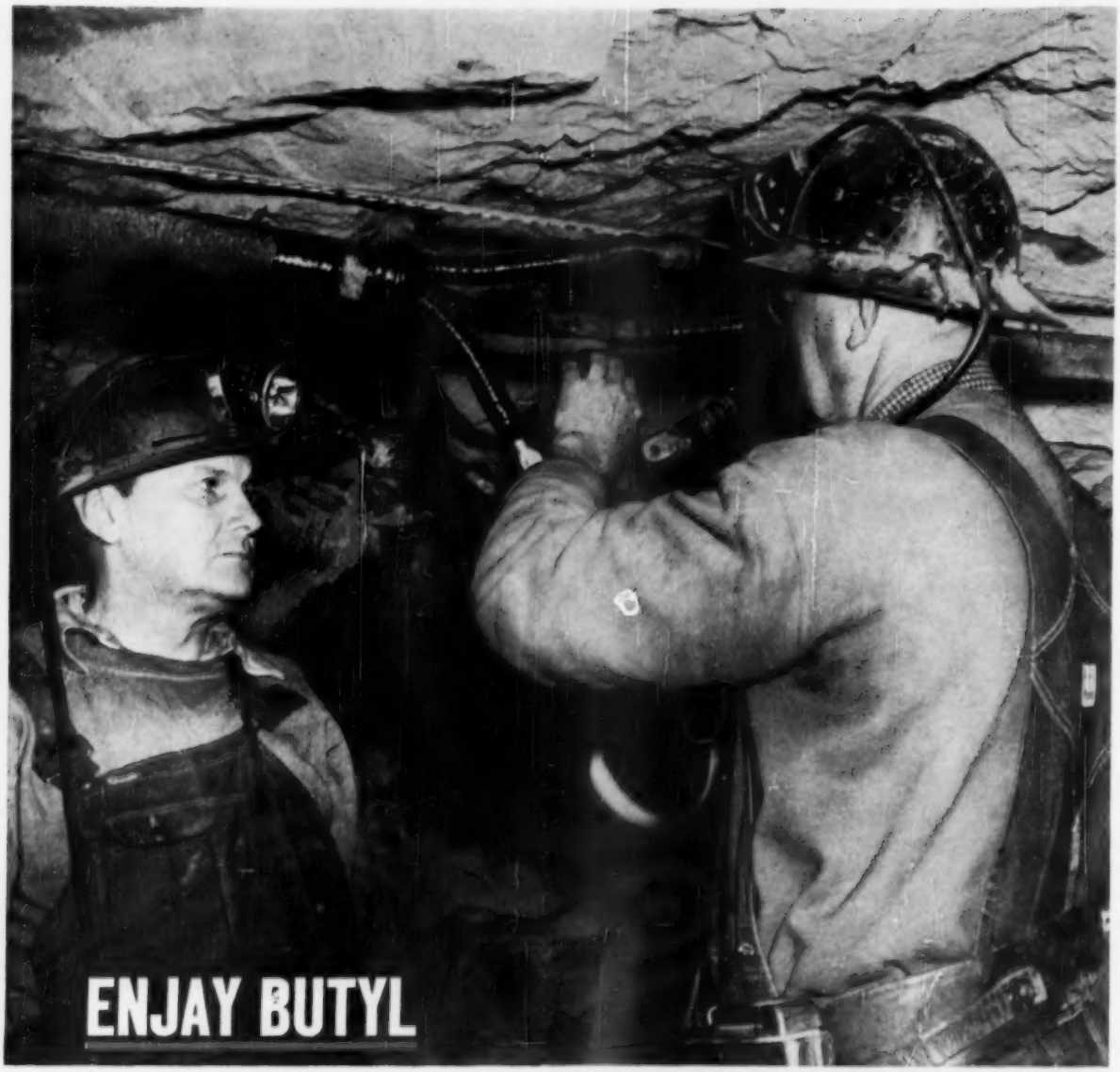


The Allison Division of General Motors has done a remarkable job of engineering, scheduling, and production on the T56 military prop-jet engine, and its commercial version, the 501. We are pleased to have a part in this engine and in Allison's fine production record; the Jet Division of Thompson Products produces major parts for the compressor and turbine sections of the T56 and the 501.

JET DIVISION

Thompson Products, Inc.

Cleveland 17, Ohio



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Performance! Versatility! Economy! In all three, Enjay Butyl is the world's outstanding rubber value. In laboratory tests, and a wide variety of applications, no other rubber has matched Enjay Butyl's ability to resist ozone and corona, impact and abrasion, moisture and weathering . . . properties that make Enjay Butyl-made products *outstanding* performers.

Underground service cables, transformer housings, high-voltage industrial cables . . . in these, and many other electrical applications, Enjay Butyl outperforms and out-lasts *all other* types of rubber, synthetic *or* natural. *Low-in-cost* and *immediately available*, this truly wonder rubber may well be able to cut costs and improve performance in *your* products. For further information, and for expert technical assistance, contact the Enjay Company.

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Today's Aircraft demands the *light weight to strength ratio* inherent in SCULPTURED COMPONENTS. The new Lockheed Electra prop-jet airliner is anexample of creative designing fulfilling a practical need in an advancing age. The skill, experience and facilities necessary to supply SCULPTURED COMPONENTS are an integral part of A.T.M.'s service.

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Ryan Aeronautical Company of San Diego, aviation history-makers with a flair for "firsts," has done it again with the successful development of the X-13 Vertijet, the world's first pure jet vertical takeoff and landing airplane. The Ryan Vertijet literally "walks on its tail" of hot exhaust gases, as it leaves and returns to its platform. Western Gear was challenged as seldom before in the design and manufacture of control components for this amazing aircraft. And Western Gear is proud of its opportunity to put to such dramatic success our vast engineering and manufacturing experience.

"The difference is reliability" • Since 1888

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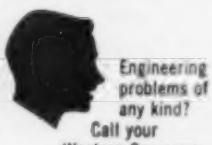

Engineering problems of any kind? Call your Western Gear man.

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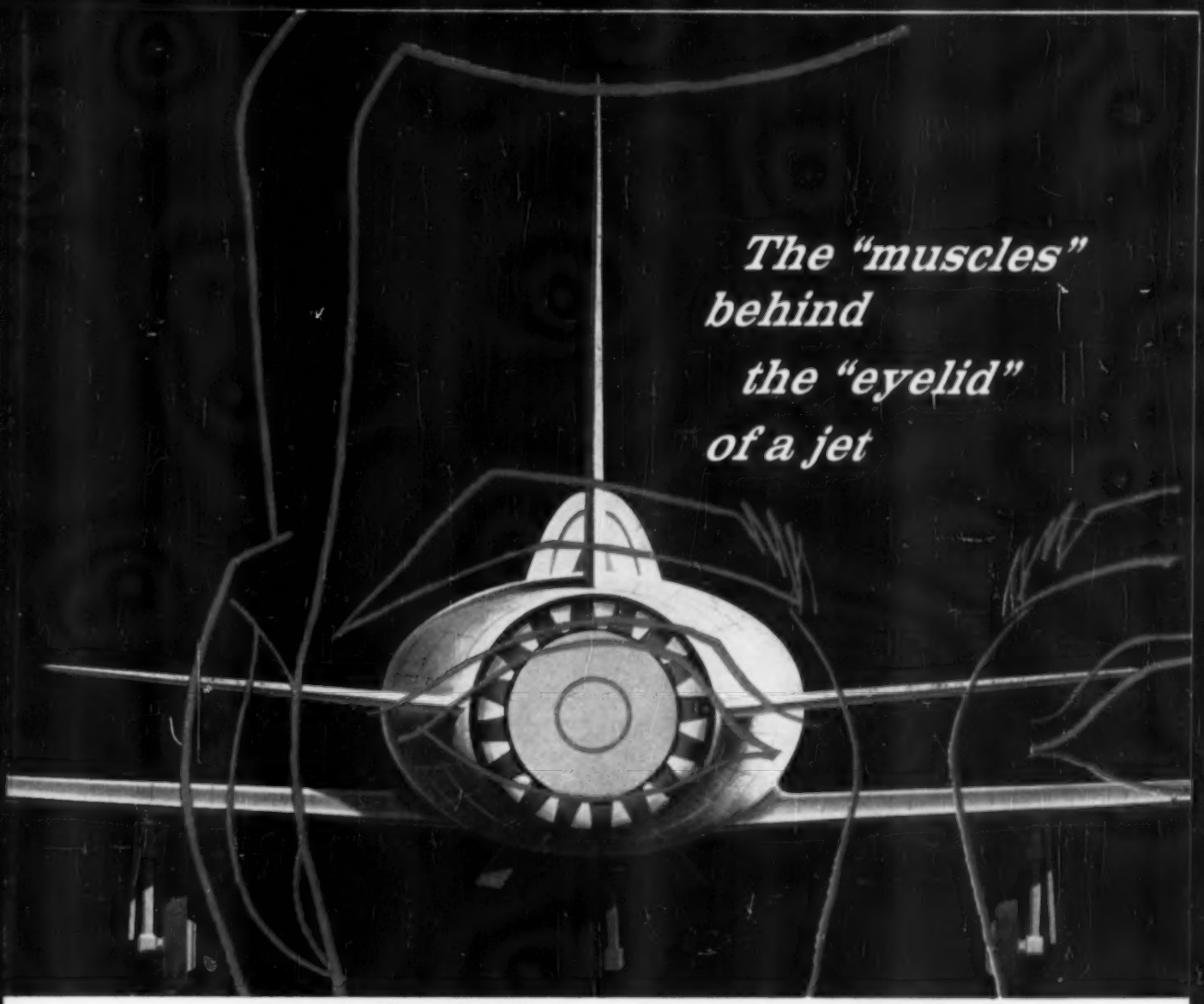

Jet aircraft using the "eyelid" type of variable area exhaust nozzles need actuators—or "muscles"—that respond instantly in temperatures ranging from minus 67 to plus 600 degrees. Ex-Cell-O builds such actuators . . . along with nozzles, blades, rotors, fuel controls, precision parts and assemblies.

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DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION XLO

Aircraft Division

MAN AND MISSILES FLY HIGHER, FASTER AND SAFER WITH PARTS AND ASSEMBLIES BY EX-CELL-O.

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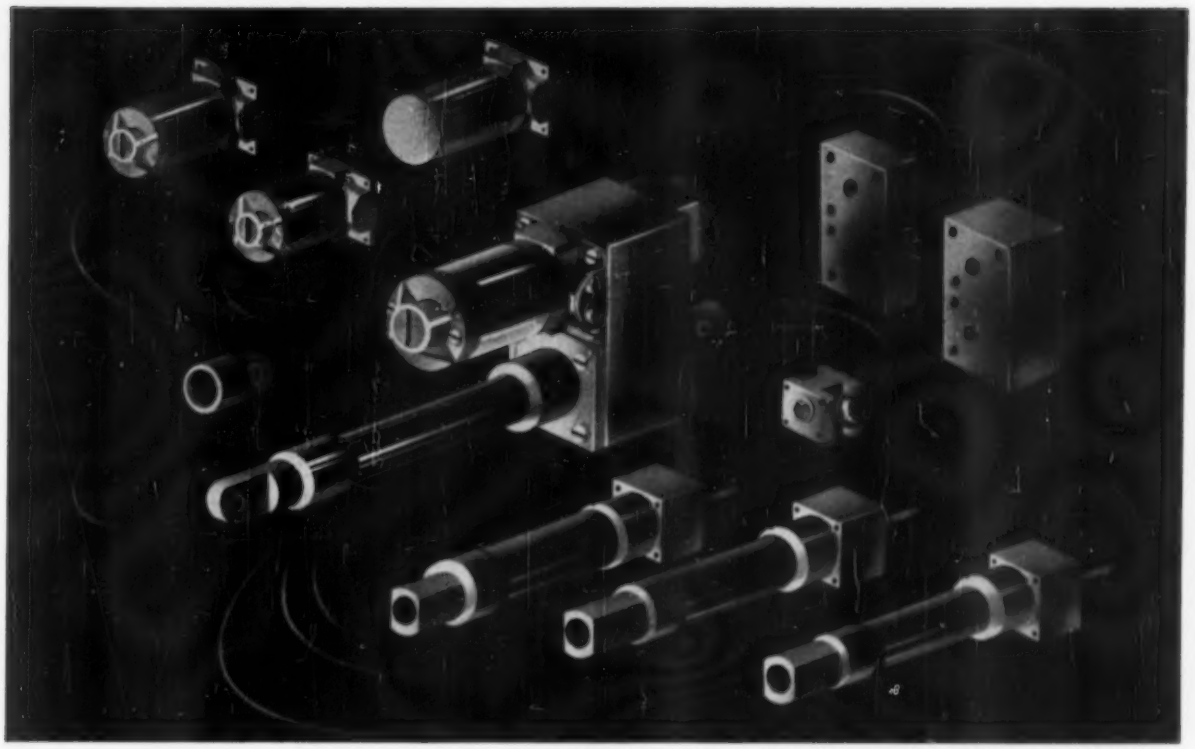
INTO FIRST-LINE JETS

To fit the USAF's new concept in Cadet training, the Cessna T-37 is now in operation. Side-by-side instruction, easy maneuverability, slow landing speed permit training time savings —and cut costs for the Air Force!

CESSNA AIRCRAFT CO., WICHITA, KANSAS

Cessna



Simplified illustration of Airborne's new modular design concept shows how actuator can be assembled from various combinations of standardized, interchangeable parts. Components actually available appear in the diagram below.

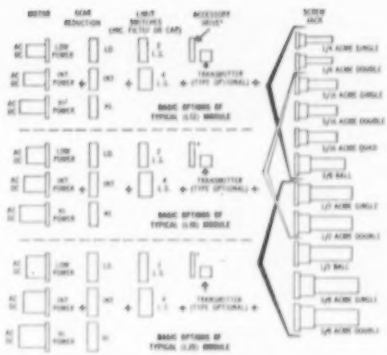
New Airborne modular actuators give you greater design freedom, help eliminate specials

Airborne's new modular concept of linear actuator design is based on a system of standardized components. These components—motors, switches, jacks—are grouped in three broad operating capacity classifications: L12—up to 350 lb.; L16—up to 2500 lb.; and L20—up to 3500 lb. All components within each classification are interchangeable.

As a result, you are no longer limited to a line of, say, a dozen standard actuators whose design is relatively fixed. Instead, you can now select any one of several hundred possible combinations from over 40 standard Airborne actuator components. In 90% of cases, this will give you a linear actuator meeting your capacity and configuration requirements exactly. Thus you have greater design freedom without becoming involved in the extra costs and delays associated with specials.

In addition, while redesigning under the modular system, we have reduced the bulk and increased the capacity of many Airborne actuator components. You get more power in a smaller package, saving valuable weight and airframe space.

Write today for further information on Airborne's new modular actuator line.



Above, the complete line of Airborne modular actuator components.

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NEW MODULAR ACTUATOR CATALOG 57A

Discusses modular design; gives operating capacity curves for the new Airborne actuator classifications; contains complete dimensional data. Write for a copy today.

GEORGE A. LEMKE, Convair's Assistant Chief Design Engineer, responsible for Propulsion and Mechanical Design, is a graduate of the University of Minnesota. Among his other responsibilities at CONVAIR-*SAN DIEGO*, he was Assistant Project Engineer on the first successful delta-wing aircraft.

"Engineers—here's the story of the 'G-Limiter' development."

"The specifications for Convair's F-102A required that this supersonic delta-wing interceptor *fly itself* during part of a tactical mission.

"To safeguard both pilot and aircraft while operating in this automatic flight mode, it was necessary to develop a 'fail-safe' feature in the control system.

"This 'G-Limiter', as it came to be called, is an electronic measuring device which sums the angular and normal acceleration of the aircraft. Then, by comparing the 'sum' to a critical reference, this device anticipates the point at which the structural limits of the aircraft will be exceeded, and initiates corrective action.

"You, as an engineer, will appreciate this kind of creative assignment—and the resulting atmosphere of accomplishment at CONVAIR-*SAN DIEGO*. You will also appreciate being an integral part of a 'systems team' of specialists—while actively contributing to programs like the USAF F-102A and our 880 commercial jet transport. Not least, you'll *enjoy* living at its best in beautiful San Diego."

For greater career opportunity at CONVAIR-*SAN DIEGO*—*for your future's sake*—write: H. T. Brooks, Engineering Personnel, Dept 69C.

Put your *ideas to use where* new *ideas are used.*

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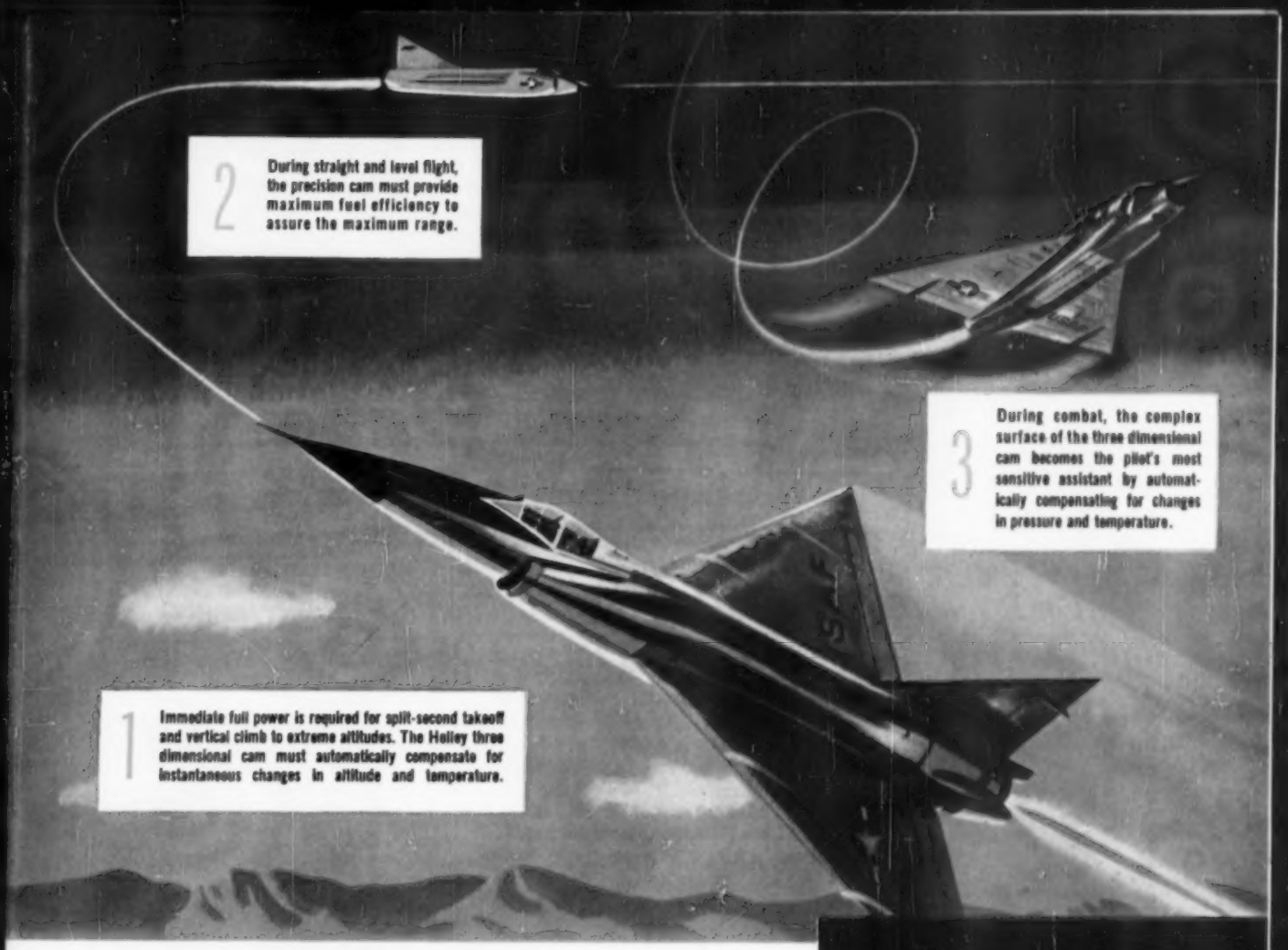
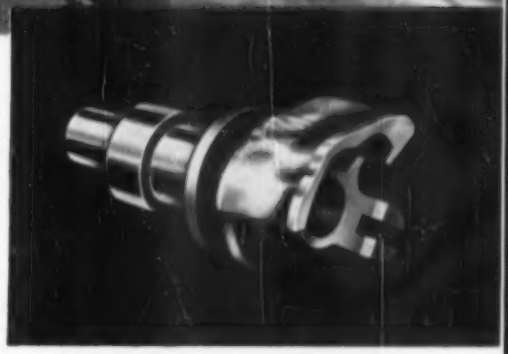

2 During straight and level flight, the precision cam must provide maximum fuel efficiency to assure the maximum range.
3 During combat, the complex surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.
1 Immediate full power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

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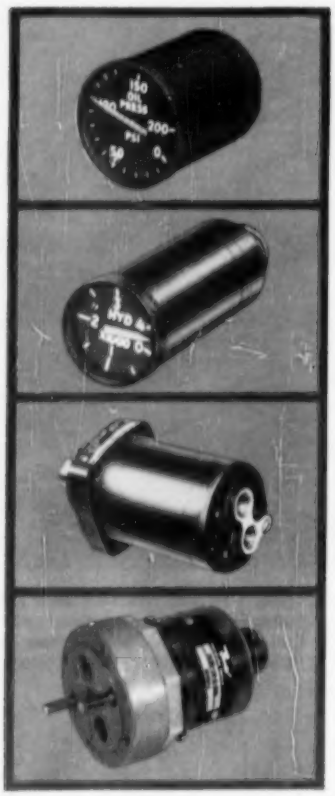
A 23

For Remote Indications, Montrose Division's 1-inch Synchro Indicator Provides Super-accuracy, Rugged Design, Easy Readability



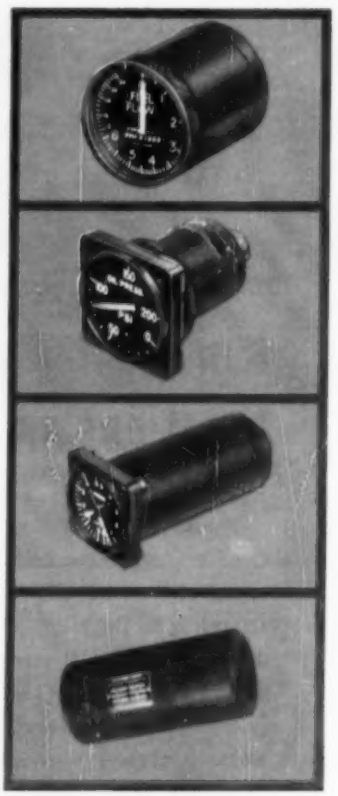
Montrose Division presents Type 26800—a single precision synchro pressure indicator with a .950-inch dial aperture—for measuring oil, manifold, hydraulic and torque pressures in a variety of ranges—depending on specific operating requirements.

Where desired, it is available with various dials to indicate fuel flow, heading, position, and other factors, when used with an appropriate transmitter.

Electrically connected to a remotely located synchro transmitter to provide a visual indication of transmitter output signal, its helium-filled and hermetically-sealed construction assures long, trouble-free life under adverse environmental conditions. Dial and pointer markings are available with R-410-AB radium, AN-L-1 fluorescent or matte white paint.

Input power required—26 volts, 400 cycles, single phase. Power rating—3.12 VA at 0.19 power factor. Operating temperature range is −55°C to +70°C. Size: One-inch diameter; weight: 2.85 oz.; accuracy: ¾°.

Montrose Division manufactures a complete line of synchronous indicators and transmitters, servoed indicating systems, warning units, heavy-duty control switches for pressure applications, and dynamotors. Montrose Division, Bendix Aviation Corporation, South Montrose, Pa.



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September 2, 1957

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COVER: Sud Aviation's latest version of the Baroudeur (S.E. 5004) ground support fighter is being reconsidered for the NATO lightweight fighter competition to be held in France this month. Improved design of Baroudeur includes more powerful Snecma Atar turbojet delivering more than 8,000 lb. thrust, ventral fins for greater stability and improved landing skids with retractable braking hooks. More than 40 landings and takeoffs have been made on the new skids. More pictures of the Baroudeur during test flights on pages 74 and 75.

Picture Credits:
74, 75—Russell Melcher; 75—David A. Anderton; 90, 92— Joe Goodyear

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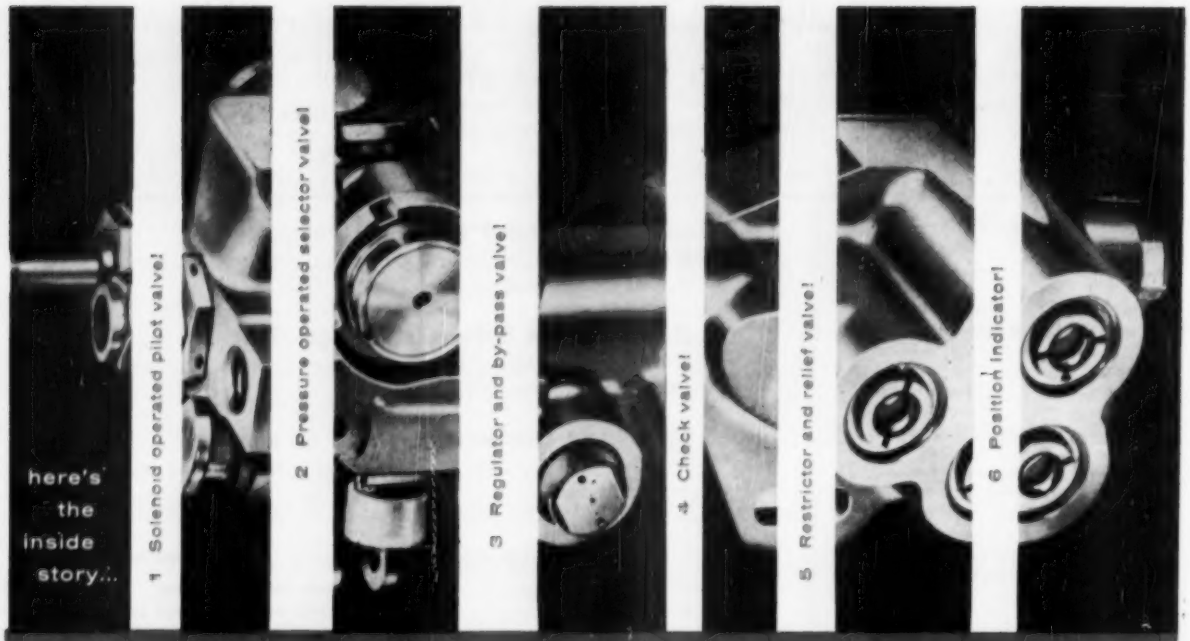
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EDITORIAL

Facts and Fiction on the ICBM

Soviet announcement of successful test firing of an intercontinental ballistic missile produced more reverberations around the world than the missile made in its impact area. The Soviet announcement put onto the public record a fact that has been well known in the Pentagon and White House for at least nine months. First public news that the Soviets had begun experimental test firings of an intercontinental type ballistic missile was printed in AVIATION WEEK May 20 (p. 26). For the past five months, top level Pentagon and White House officials have been deeply concerned with how to cushion the effects on the American people and world opinion of the inevitable Soviet announcement of this fact.

The timing of the Soviet announcement indicates clearly how powerfully the relative achievements of the U.S. and the USSR in the current technological armament race loom as a support of foreign policy. We warned last year after the Suez crisis (AW Dec. 3, p. 21) that the era of ballistic blackmail had dawned and henceforth the long range ballistic missile, whether actually used against an enemy or not, would add significant weight to the international balance of power. The Soviets first used their intermediate range ballistic missile capability as a diplomatic threat against England and France in the Suez crisis. Once again the Soviets have waited for a propitious moment in international diplomatic negotiations to turn their ICBM card face up on the disarmament conference poker table. The Soviet announcement timed the successful ICBM firing as "a few days" before the official release. This may well be true. The first experimental firings began last winter, and there have been a number of test firings since at the irregular intervals that distinguish experimental testing from the routine firing of samples from a missile production line. It is possible that the most recent Soviet ICBM firing was the first reasonably successful round in the experimental program and was considered the first sufficiently solid technical performance to warrant a public boast.

At any rate, the Soviets played their announcement to get maximum diplomatic value in the current disarmament conference and to back an increasingly tough policy vis a vis the U.S. It will take some time before it becomes clear exactly how both the Soviet announcement and the official U.S. counter statements by Secretary of State John Foster Dulles and Deputy Secretary of Defense Donald Quarles are evaluated by our allies and the neutrals.

Many Americans will wonder how a technically undeveloped country such as the Soviet Union can even be in a position to seriously challenge the U.S. in such a technologically sophisticated field as ballistic missiles. The fault lies not with the quality or industry of U.S. technology but rather with the lack of imagination, courage and candor in our political leaders. Missile men the world over (except perhaps in Stalinist versions of Russian technical history) acknowledge an American, Dr. Robert Goddard, as the pioneer of modern rocketry, but he received no official support and little private backing to continue his important work. The Germans picked up Goddard's basic technology and went on to develop the V-2, first modern ballistic missile.

With the fall of Germany in 1945, both the U.S. and USSR had access to the substantial accumulation of ballistic missile technology developed by the Peenemunde project. Both countries in effect started from scratch in the ballistic missile business in 1946.

We have the word of a Soviet Air Force Colonel, G. A. Tokaev, an anti-Stalin defector who was in charge of organizing the aircraft and missile brains of Germany to work for Russia, that ballistic missile development was given top priority from the very start of the Soviet's post war armament program. It was not many years after the end of World War II that Soviet developments of the German V-2 began impacting in Sweden after test firings over the Baltic Sea.

This country too began an intensive development program based on the German V-2 and also independent approaches by Convair, the Martin Co. and North American Aviation Inc. that produced significant new knowledge.

In the military economy wave of 1949 ordered by President Truman and executed by the then Defense Secretary, Louis Johnson, the ballistic missile development program virtually evaporated along with the 70 group Air Force program.

For the next five years—from 1949 to 1954—the pace of ballistic missile development in this country slowed to a leisurely walk. During this same period the Soviets continued their top priority on ballistic missile development. It was the old story of the tortoise and the hare. While the U.S. hare took a forced nap through an "economy budget" sleeping pill, the Soviet tortoise plodded on at a steady if not spectacular pace.

There is no magic on either side of the Iron Curtain in ballistic missile progress. It is slow learning by trial and error, and the rate of progress is determined more by the time and scope of sustained support than by any brilliant technological breakthrough. When in 1954 the U.S. suddenly became excited about the ICBM because of the feasibility of hydrogen warheads, money and manpower were poured into the program indiscriminately. Instead of concentrating on two, or at the most three, different programs, Defense Department dissipated both money and the limited technical resources then available on no less than five ballistic missile programs, including three in the strategically insignificant area of intermediate ranges. Thus, our history of ballistic missile development has ranged from a promising start through fund starvation to a glut of funds that cannot be assimilated by our limited technical resources to recoup the irreparably lost years dominated by the "economy" wave. Against this background, the Soviet scientists have plodded steadily onward, not unduly daunted by failures, getting all the foreign technical assistance they could and backed by top priority from their political leaders.

This is why today we are running neck and neck with the Soviets in the ballistic missile race—a race that we would have won hands down if our political leaders had supported our technological capability. —**Robert Hotz**

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WHO'S WHERE

In the Front Office

Walter J. Kalmeyer and **Norman Pitt**, directors, Standard Steel Corp., Los Angeles, Calif. Also: **Robert R. Johnson**, a vice president.

Richard H. Perley, vice president and general manager, Hycon Aerial Surveys, Inc., Pasadena, Calif.

A. F. Anzlovar, vice president and general manager, The Mercast Manufacturing Corp., La Verne, Calif.

Earl D. Hilburn, vice president-development, Link Aviation, Inc., Binghamton, N. Y.

R. E. Esch, a vice president, Vickers Inc., Detroit, Mich.

Roy Baker Snapp, divisional vice president, Atomics Division, American Machine & Foundry Co., New York, N. Y.

Pierre G. Desautels, vice president-passenger service, Trans World Airlines, Inc. Mr. Desautels succeeds **John H. Clemson** now handling special assignments for the president's office.

Leonard Pincus, a vice president, Airtron, Inc., Linden, N. J.

Bertram Cole, corporate director-marketing and distribution (commercial products), American Bosch Arma Corp., Hempstead, N. Y.

Honors and Elections

The American Society of Mechanical Engineers has announced that **Dr. Charles Stark Draper**, Head of the Aeronautical Engineering Department and Director of the Instrumentation Laboratory of the Massachusetts Institute of Technology, has been awarded the Holley Medal, which is awarded only for a "great and unique act of engineering genius." Dr. Draper discovered a new principle for controlling guns fired from moving platforms at moving targets.

Capt. R. L. Wagner, retiring from United Airlines after 30 years of flying, was the first recipient of Flight Safety Foundation's newly inaugurated "Patriarch Pilot" award. The award will be presented to other pilots from time to time, with their safety achievements reported and recorded by Flight Safety Foundation.

Changes

Clifford A. Busse, engineering manager, Electronics Division, Rheem Manufacturing Co., Rivera, Calif.

Elmer R. Easton, general manager, Wyle Associates, El Segundo, Calif.

Eric B. Moss, director of engineering, Canadian Applied Research Ltd., Toronto, Canada.

The Engineering Department, Government and Industrial Division, Philco Corp., Philadelphia, Pa., announced the following appointments: **James B. Williams**, director-weapon system engineering; **Herman A. Affel**, director-computer and control engineering; **John Colocousis**, chief mechanical engineer.

(*Continued on p. 108*)

INDUSTRY OBSERVER

► McDonnell Aircraft Corp. is building two prototypes of a turbine-powered helicopter for troop transport missions. Powered by two engines, first prototype is scheduled to fly by about Oct. 1. USAF provided the engines for the prototypes, with McDonnell bearing other costs.

► **De Havilland Gyron engine with afterburner (AW Aug. 26, p. 62) has been run at more than 27,000 lb. thrust. Highest figure previously announced for the engine is 25,000 lb.**

► New monocular ranging technique for infrared systems developed by General Electric gives accurate target range from single optical scanner, opening the way to simplified fire control systems. Ranging feature reportedly adds only few pounds in weight. Application of monocular ranging to proposed infrared proximity warning indicator (AW Aug. 12, p. 77) could greatly increase its utility by giving pilot an indication of intruder distance as well as bearing.

► **Sikorsky S-61 is a commercial version of the company's gas turbine powered development of the S-58 helicopter now flying in an experimental version. S-61 would be powered by two General Electric T58 turbine engines mounted on top of the fuselage with the pilot's cabin moved down to the main passenger cabin level. Passenger capacity would be about 16 people.**

► Full scale component tests using sintered wire wound turbine blades will be run by Wright Aeronautical Division of Curtiss-Wright Corp. In new engine development, cooled blades will be checked for operation at 1,700F in gas stream between 2,500 and 2,800F. Blade root attachment also will be studied.

► **Northrop will receive afterburner model of General Electric's J85 turbojet for its T-38 supersonic trainer. North American will get a model of the engine without afterburner for its Sabreliner jet utility trainer transport. First delivery of the J85 will be made next summer.**

► First Firestone Corporal missile is scheduled to be fired by the British Army on new Scottish missile test range in the Hebrides Islands in 1958. British Army will get the U. S. developed and produced Corporal short range surface-to-surface missile for its first operational guided missile units.

► **Bell Helicopter Corp. has developed a new horizon presentation for helicopter instrument panels which it will present to the Army sometime this fall for evaluation as part of an improved panel layout designed by Bell using available equipment. New instrument uses a five inch cathode ray tube to give a more sensitive indication of change in attitude than is available from aircraft type horizon displays.**

► Blackburn NA. 39 supersonic twin-engine bomber under construction for the Royal Navy will be powered by two de Havilland Gyron Junior engines.

► **Current rotary-wing drone possibilities include one concept employing nuclear propulsion. Army feasibility study is considering this device for unmanned movement of supplies to troops at front. One idea would provide a lightweight shielded power package.**

► Studies are under way at Lockheed Aircraft Corp. on the feasibility of manufacturing 1049H passenger-cargo configuration fitted with Allison 501-D13 turboprop engines which will power the company's Electra transport.

► **All but one of 31 HASP (High Altitude Sounding Projectile) rockets fired by Navy in tests at Wallops Island, Va., range were successful. Based on Army Loki rocket, HASP is fired from five-inch naval guns, seeks temperature and humidity data at altitudes above 20 mi. (AW April 22, p. 31). Parachute equipped HASPs are to be fired in October. Weather instruments are to be evaluated next spring. Altitudes above 100,000 ft. already have been reached.**

HOW THE SILICONES MAN HELPED...

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Accuracy that could hit a fly from a screaming roller coaster . . . so rugged that it can be used to drive nails without impairing its operation. That's the "impossible" fire control gyro built by Minneapolis Honeywell, Aeronautical Division. Known as the HIG-5 (Hermetic Integrating Gyro), lightweight and small enough to hold in the palm of your hand, it supplies the "sense of balance" necessary at supersonic speeds.

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Washington Roundup

Airlift Pressure

Despite Defense Department's austerity budget, watch for increasing pressure from the armed forces, particularly the Army, for improved strategic airlift capabilities. In addition to the Martin SeaMistress concept (see p. 29) there are a number of other possibilities with loud champions and equally vociferous opponents. The arguments rage both between and within the services. Some Army spokesmen are beginning to care less about which program is adopted than they are concerned over the delay in action on any program. Sudden wave of interest in our capability to fight a limited or Korean-type war adds new urgency to the demand for adequate airlift. Army is reorganizing into new pentomic divisions for fast action in limited war areas, but top officials fear they could not get sufficient airlift to move a streamlined division to the front with its fighting tools.

D. C. Airport

Prospect for a new airport to handle some of Washington's mounting air traffic congestion is still uncertain.

Congress has appropriated $12.5 million for the project, but with this stipulation—"that no funds shall be expended for construction and development . . . until the President shall make a report to the Congress with a recommendation as to the site . . ." The recommendation is due Jan. 15. The President and the Department of Commerce after studies and re-studies over the past decade have consistently recommended location at Burke, Va. The stipulation means that should Burke again be recommended, as seems likely, opponents of this location will have another opportunity to kill off the project, as they have been successful in doing so far.

Meanwhile, the new study to determine a location will be directed by Lt. Gen. Elwood P. Quesada, presidential assistant for aviation planning.

Deep Freeze

First aircraft headed for Antarctic Operation Deep Freeze III, this year's scientific excursion to the bottom of the world, will take off this week. Total of 44 planes will take part. Eight are Douglas C-124 Globemasters from 18th Air Force. Twenty-three are Navy aircraft, ranging from the Lockheed P2V-7 to the de Havilland Otter, all attached to Air Development Squadron Six at Quonset Pt., R. I. There will be 13 Navy helicopters on hand for this winter's operation.

Enlistment Stretch

Following USAF's lead (AW Aug. 26, p. 25), Navy will require five-year enlistment of aviation training candidates beginning Jan. 1. Economy will result from three and a half years of active duty after training, instead of the present two years. Training costs more than $100,000 for each pilot. Exempt from the new regulation—Naveads (Naval Aviation Cadets).

Alaska Certification

President Eisenhower last week signed a bill authorizing permanent certification of U. S.-Alaska airlines but did so "reluctantly" on grounds that "the number of U. S.-Alaska carriers is excessive." The President held the bill on his desk until the last possible moment before deciding to sign it to give credence to earlier rumors that vigorous opposition to the legislation by Commerce Secretary Sinclair Weeks could lead to a veto. The new law will grant permanent operating authority to Pacific Northern Airlines, Alaska Airlines and a route segment of Northwest Airlines. President Eisenhower said in signing the bill that "it was hoped that Alaska Airlines and Pacific Northern Airlines might effect a merger." But since no merger has taken place, he added, subsidies of the two airlines have "risen by about $900,000. At the present time, that charge is over $3,000,000."

Guaranteed Loan

Legislation providing for government guarantee of private loans to local service carriers managed to pass by Congress after having shaken off two proposed amendments that would have whittled the scope of the bill. Originally, the Senate bill excluded helicopter airlines but, on assurances that the Civil Aeronautics Board would watch this segment of the industry "very closely," the measure was passed to include the helicopter lines. Another amendment that originated in the Senate would have limited loans to cover only aircraft manufactured under a U.S. type certificate issued after the enactment of the loan legislation. Senator Mike Monroney (D.-Okla.) pointed out that this would have the effect of restricting loans to three aircraft—Fairchild F-27 Friendship, the proposed Douglas 1940 (AW March 25, p. 38) and the Frye Safari. He added that since at least one carrier improved its "economic operations tremendously by the use of Martin planes," the legislation was rewritten to provide loans for any aircraft which, in the eyes of the CAB, would actually improve the service.

Claims Against Rails

Supplemental airlines are increasing their claims against railroads for violating antitrust laws in bidding on military business to a total of $144.6 million. Five lines already have won damages of $45 million from the U.S. District Court for the District of Columbia. Twenty-six additional lines have now joined in the case pending before the U.S. Court of Appeals for damages of $99.6 million more. Meanwhile, Congress passed legislation in the adjournment rush explicitly authorizing the rails to act in collusion in fixing rates on military business. Its effect on the court case will undoubtedly be the subject of prolonged legal arguments. Congress, however, stipulated that the legislation was to have no effect.

Color Barrier Crack

Important crack in airlines' color barrier was made by appointment of James O. Plinton, a Negro, as Trans World Airlines executive assistant to the director of personnel and industrial relations. Appointment is first of Negro to an airline policy making executive job.

Plinton, former Air Force pilot and airport manager, is a graduate of Lincoln University with extensive aviation and business experience. TWA, under fire on charges of racial discrimination in turning down applicants for flight crew jobs (AW July 8, p. 41), drew praise from Vice President Richard Nixon and the Urban League of New York, among others, for the action. At the same time pressure on the airlines to hire Negro crew members hasn't slacked off, can be expected to mount.

—Washington staff

USAF Spells Out Procurement Policies

Soviet firing won't affect ICBM program, Douglas tells West Coast industry; Irvine stresses cuts.

By Richard Sweeney

Los Angeles—Russian announcement of successful firing of an ICBM should not be surprising, and even if evidence supporting the announcement shows up, Air Force Secretary James Douglas does not feel it will cause USAF to make any change in its ballistic missile program.

Douglas and Lt. Gen. C. S. Irvine, USAF deputy chief of staff, materiels, were featured speakers at a large meeting of Southern California aircraft industry leaders sponsored last week by Los Angeles Chamber of Commerce and Los Angeles Air Procurement District, at which USAF future procurement plans as they affect this area were outlined.

Missile Philosophy

The secretary went on to point out that:

- **Ballistic missiles** are only one method of delivering a warhead, and for some time yet they will not approach the reliability of a manned aircraft in striking designated targets.
- **USAF**, which presently leads the world in retaliatory capability with its B-47 and KC-97 team, the B-52 and upcoming KC-135 combination, feels development of a long range, supersonic manned bomber WS-110A is a high priority project.

Douglas said he could not give the date for a decision on the next step in the WS-110A program.

- **Pilotless bombers,** such as Snark also figure in long range delivery systems.
- **All long range** delivery systems are affected by developments in any one long range delivery system.
- **USAF will go ahead** with Atlas and Titan, and other long range delivery systems such as bombers plus air-ground missiles and will continue some distance down the road before decisions on their future are made.

In addition, Douglas said, in the tactical field USAF must provide advanced fighter-bombers, tactical missiles and adequate airlift. New airlift capability is one area hard hit in cutback, the C-132 was canceled and no production money for C-133A is allotted in this year's budget although existing funded contracts will carry project slowly until new buying year opens.

Concerning Southern California specifically, Douglas indicated there will be no more cutbacks in the area this year. Stretchouts for Lockheed F-104 and Convair F-106 have extended programs one year and have had a stabilizing overall effect, Douglas said.

The secretary told the meeting that the 25 to 30% of USAF prime and subcontract work which is done in the metropolitan Los Angeles area will stay unchanged this fiscal year. He also declared that dispersal is a dead issue for the area's concentrated aeronautical industry.

Industry Commended

Douglas commended industry for "large savings that have been promised and delivered, and in some instances without any effect upon production schedules."

For its part, USAF will reduce its military personnel by 25,000 by Dec. 31, to bring USAF strength down to 900,000. In civilian personnel, 5% or 20,000 will be lopped from payrolls by Oct. 31.

Irvine told the assemblage of 1,000 industry representatives that USAF now finds it necessary to follow certain safeguards, chiefly one in which senior USAF commanders and members of the air staff work out a system of mission priorities and mission solutions for future requirements, and development and production programs are established on this basis.

While the practice is not new, Irvine continued, it now gets added emphasis, resulting in "a more rigid view of all development projects . . . retaining only those which show distinct promise for significant operational advantages.

"Small improvements or low priority projects will have to fall by the wayside."

Concerning the specific impact of dollar availability and mission solutions on the primary and supporting aircraft industries, Irvine said:

- **Many major companies** and their subcontractors will experience slowdowns, stretchouts or downright cancellation of projects as a result of mission priorities and solutions decision, not because it is a certain company project or located in a specific area.
- **Sharp reduction** in requirement for high bay facilities will follow as missile production rises and that of manned large aircraft decreases. USAF means to check closely to eliminate all present facilities which are unuseable for productive manufacturing, maintenance and storage purposes, although new facilities the missile programs require for test and assembly will have to be built in isolated locations.
- **Fewer dollars** this fiscal year—about 6% of the rate in the last six months of last year—will be spent on relatively fewer programs and fewer end items. To be really competitive for these dollars, companies should take a hard look at their management and engineering practices and production techniques with a view toward cutting "front office" costs, reducing excess engineering and manufacturing space and personnel, unnecessary premium cost overtime and plant operating expenses. "We want more really new hardware and less overhead," he said.

Fund Limits

Since USAF must stay within present fund limits, Irvine said, it is setting up programs and procedures which will control and forecast expenditures right down to the plant, so trends can be determined month by month, quarter by quarter, by contract and by company. If expenditures run over estimates, quantities will be reduced, or if unit costs get too high USAF may cancel the program "not because we want to, but because we must stay within the

Special Staff Coverage

Aviation Week's editorial policy of on the spot staff coverage of all major international aviation events will be continued this fall in England and Spain. David A. Anderton, chief of Aviation Week's European office in Geneva, Switzerland, will report on the 1957 Flying Display of the Society of British Aircraft Constructors at Farnborough and is a delegate to the Sixth International Aeronautical Conference in London and Folkstone, a joint operation of the Royal Aeronautical Society and the Institute of Aeronautical Sciences. Later Mr. Anderton will attend as a delegate and report for Aviation Week the Eighth Annual Congress of the International Astronautical Federation in Barcelona, Spain.

L. L. Doty, transport editor, will cover the 13th annual general meeting of the International Air Transport Assn. in Madrid Sept. 9-16. Special picture coverage of the SBAC Flying Display will be provided by Russell Melcher whose work will be remembered by Aviation Week readers from the 22nd Salon Aeronautique Internationale at Paris last June.

USAF Ballistic Missile Who's Who

Principal contractors in Air Force ballistic missile program, and their roles, are as follows:

Atlas:

- Airframe: Convair
- Nose Cone: General Electric
- Propulsion: North American
- Guidance: General Electric (ground-based radar and radio control) and Burroughs (computation facility.)

Titan:

- Airframe: Martin
- Nose cone: Avco
- Propulsion: Aerojet-General
- Guidance: American Bosch Arma (inertial), Bell Telephone Laboratories (ground-based radar) and Sperry-Rand (computation facility.)

Thor:

- Airframes: Douglas
- Nose Cone: General Electric
- Propulsion: North American
- Guidance: A. C. Spark Plug (inertial), Bell Telephone Laboratories (ground-based radar.)

various planned dollar limits."

He urged advanced management techniques such as numerical and tape control of machines, use of electronic data processing and really modern tooling methods which will result in more pounds of hardware per labor hour and more productive designs per engineering hour.

Concerning subcontractors, Irvine said USAF will continue to require prime and associate contractors to subcontract a substantial portion of their workload to specializing firms and small businesses, USAF wants to make sure subcontracting is done on as competitive basis as possible.

But he noted that:

- **"Make or buy"** philosophy must prevail. Contractor is expected to follow the most economical course of action.
- **USAF does not** want a prime or associate contractor to recall subcontracts or to tool up to produce what he could buy elsewhere just to compensate for reductions caused by stretchouts or cancellations.
- **USAF does not intend** its funds to be paid to small business unless a dollar gets a dollar's worth of hardware. There will be no subsidizing the marginal, high cost, late delivery people.

Irvine also pointed out that there will be some USAF retrenchment in maintenance, modification and overhaul by Air Force depot or by contractors, for other than first-line aircraft. USAF intends to do normal base maintenance on older types of aircraft until they reach the condition of being non-flyable without major overhaul, at which time they will be retired.

Russia Confirms ICBM Firing; Congress Debates U.S. Progress

Washington—Soviet Union officially announced last week it has successfully fired a multi-stage intercontinental ballistic missile over "a huge distance" and said "the rocket landed in the target area." AVIATION WEEK exclusively reported the first flight test of a Russian ICBM on May 20 (p. 26).

First test firing of Air Force Atlas ICBM occurred at Patrick AFB last June 11. The missile was destroyed after a 22-sec. flight because of an engine gimbaling system malfunction (AW June 17, p. 27; July 15, p. 29).

Next Atlas firing test is scheduled for October. Convair Division of General Dynamics Corp. has produced more than a dozen Atlases for test purposes. USAF plans call for 40 operational Atlases in the inventory by 1959 and 80 operational Titan ICBMs by 1961.

Titan, with Martin Co. as prime systems contractor, still is at least a year away from initial test firing.

(See Atlas drawing on p. 28.)

Truth of the Russian announcement generally went unchallenged in official comments. First official reaction aside from Congressional comments came not from Department of Defense but from Secretary of State John Foster Dulles at a press conference. This was followed 24 hours after the Russian announcement by a press release quoting Deputy Secretary of Defense Donald A. Quarles. His statement had been cleared by State Department and the White House.

Dulles said the U.S. has "no independent means of verification" of the Russian statement but said "we have no particular reason to doubt the veracity of the announcement . . . although . . . the words were very carefully chosen and could cover much or could cover little. . . . In general, the Soviet statements in this area have had some supporting fact."

Quarles said the announcement "was not surprising," and that "we have for some time credited the Soviets with substantial progress in the long range ballistic missile field and have made it clear that our own work in this same field is being pressed forward on a broad front and with a high priority."

Both Dulles and Quarles pointed out the obvious propaganda value of the timing of the announcement, with disarmament talks under way in London, an internal crisis in Syria and a meeting of the United Nations upcoming.

"Time differences in terms of operation readiness will probably not be very great one way or the other," Quarles statement said, "and the immediate military significance of the so-called race (between Russia and the U.S.) has been greatly exaggerated."

Quarles also took issue with earlier reports of Soviet missile progress. "It will be recalled," he said, "that about a year and a half ago we went through a period when there were indications, later unsubstantiated, that the Soviets had out-stripped us in the ballistic missile field. The Defense Department made it clear at that time that the facts did not support the importance being attached to these earlier indications."

Late last year Russia was testing intermediate range ballistic missiles at about five per month on a regular schedule (AW Dec. 3, p. 21), indicating these were tests of production missiles and not experimental prototypes. Russian IRBM firings have been going on since at least mid-1955 (AW Feb. 20, p. 26, 1956). First successful U.S. IRBM firing came last June. It was an Army Jupiter. USAF Thor IRBM has

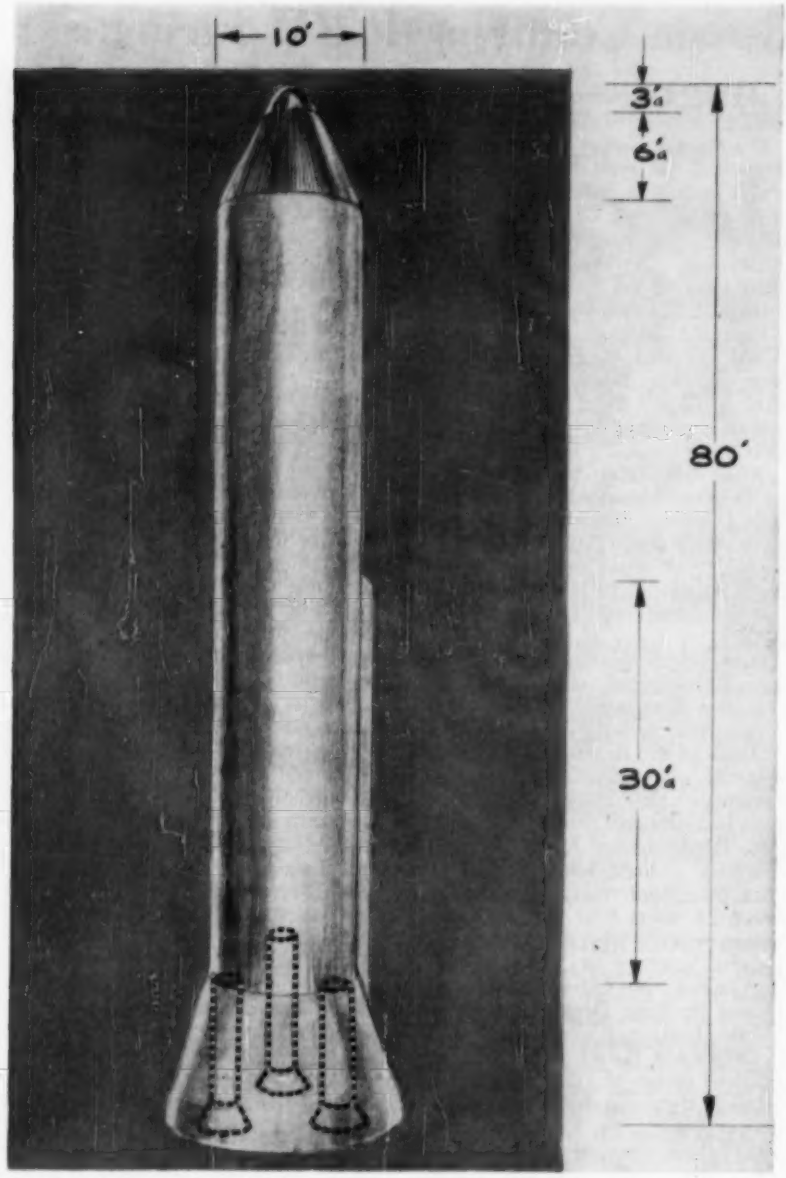
ICBM Debate

Washington—House Appropriations Committee said in its report on Defense Department's Fiscal 1958 budget in May that "we are no doubt ahead of the Soviets in the field of guided missiles generally."

"In the ballistic missile field we are probably behind the Soviet Union in progress made in the perfection of the intermediate range ballistic missile," the report said.

"In the intercontinental ballistic missile area we are very probably ahead of the Soviets. As Gen. Twining points out, we are no doubt ahead of the USSR in the important field of operational know-how but it must be admitted that the Soviets are making important progress in this area . . . there is no room for complacency among our people in the consideration of our defense program."

Trevor Gardner, former USAF Assistant Secretary for Research and Development, told the Senate Airpower Investigating Committee last year that he believed Russia was ahead of the U. S. in development of the IRBM and might or might not come out ahead on the ICBM, since they had taken a "step by step . . . methodical German approach" and "we decided to go for the ICBM in one jump."



AVIATION WEEK artist's sketch of the Convair Atlas ICBM shows features visible in movie film shot from public property several miles from Cape Canaveral, Fla., launching pad. These include external guidance package, corrugated blunt nost cone, two stage propulsion system.

not as yet had a successful flight.

Sen. Henry M. Jackson (D.-Wash.) cited the "general cutback of defense programs" and said "even the ballistic missile program—despite its priority—has not been spared." He called for full-speed development of IRBMs and ICBMs and an increase in the production rate of the Boeing B-52 intercontinental bomber.

Jackson said target dates for achievment of operational IRBMs and ICBMs "have been postponed" and that "there has been a substantial slippage in the progress of our research and development on these weapons."

But other congressional leaders said money is not the problem.

"While it is true that the Defense Department is not spending money as fast as it originally contemplated on our ICBM program, it is also true that there has been no holdback," Rep. George Mahon (D.-Tex.), chairman of the House Armed Services Appropriations Subcommittee said.

"There has been no cutback in the program that would be detrimental. We are moving forward as fast as is advisable."

Rep. John Taber (R.-N.Y.), ranking minority member of House Appropriations Committee, said "it is not true that economy—either on the part of Congress or the administration—has affected our efforts."

"The slowdown," Rep. Taber said, "has been in areas where we are piling up stuff for a stockpile and where it isn't needed and which will be obsolete shortly. There is not a bit of truth in any allegation that there has been a slowdown in the ICBM program. There has been no economy in the things that count."

Sen. Stuart Symington (D.-Mo.), also charged economy is hampering development. He said it is "almost inconceivable to realize that this administration has slowed down our effort (on ICBMs) for purely budgetary and fiscal reasons."

Sen. Leverett Saltonstall (R.-Mass.), the administration's top Capitol Hill spokesman on defense matters, disagreed, saying no reappraisal of the defense program is necessary.

"Without pulling the top off the barrel and having an explosion in all directions, all expenditures or appropriations that could be reasonably substantiated for the ICBM or for research and development have been made," Sen. Saltonstall said. "Our military people have been moving forward as fast as they can and with the prospect in view of guided missile developments by other nations as well as ourselves."

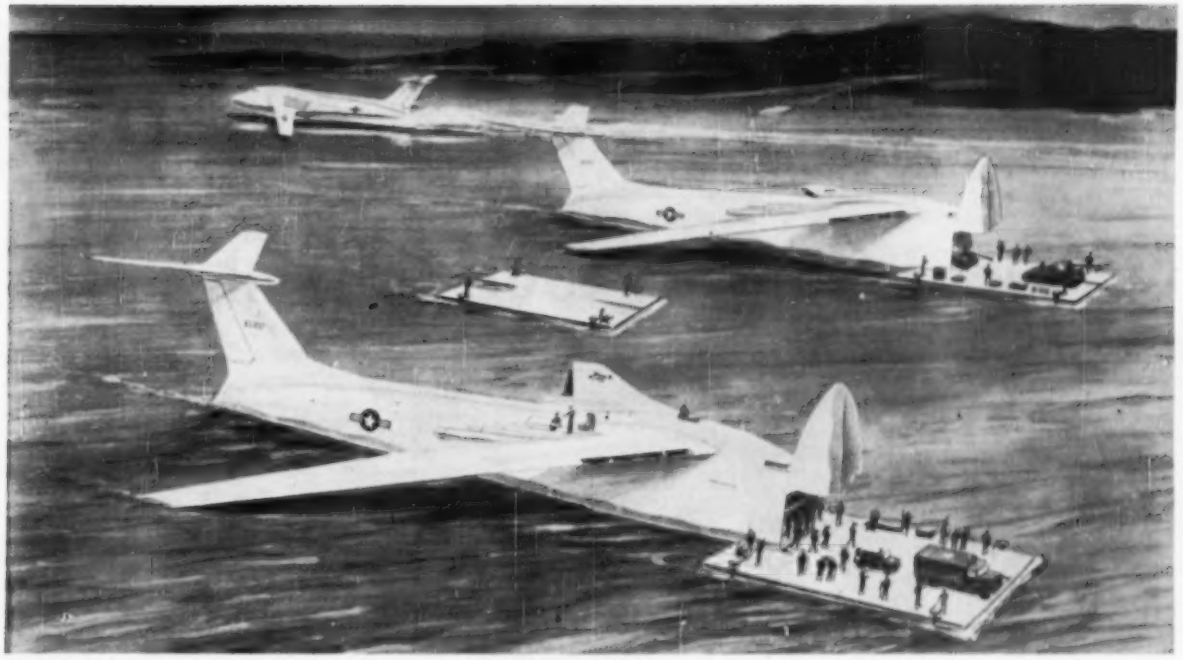
Russian statement of the missile firing also discussed recent test explosions of nuclear and thermonuclear weapons in the Soviet Union. Nothing in the statement, however, related nuclear or thermonuclear weapons directly to a warhead for rockets.

The "super-long-distance intercontinental multi-stage ballistic rocket was launched a few days ago," the Russian statement said. "The tests . . . were successful. They fully confirmed the correctness of the calculations and the selected design."

"The rocket flew at a very high, unprecedented altitude," the statement said. "Covering a huge distance in a brief time the rocket landed in the target area. The results obtained show that it is possible to direct rockets into any part of the world.

"The solution of the problem of designing international ballistic rockets will make it possible to reach remote areas without resorting to a strategic air force, which at the present time is vulnerable to up-to-date means of antiaircraft defense."

Air Force has not been allowed to make any official statement about test firing of its Atlas ICBM or planned schedule for Titan ICBM test firings. Even intermediate range ballistic missile firings from Patrick AFB go unidentified so far as official comment is concerned.



WATER based air logistics system built around eight jet Martin SeaMistress, twice the size of P6M, is depicted by artist.

Martin Proposes New Air Logistics Plan

By Evert Clark

Washington—Eight-jet SeaMistress aircraft, heart of a water based air logistics system and twice the size of the P6M SeaMaster, was proposed last week by the Martin Co.

Martin also opened a campaign to stir public and congressional discussion of what it called a lack of adequate military airlift and the "roadblocks" in the way of achieving it.

Bow-loading SeaMistress would have approximately twice the SeaMaster's 134 ft. length and 100 ft. span, a speed of 500-600 kt. and a gross weight for over-ocean flight of 500,000 lb.

First generation would be powered by Pratt & Whitney J75 turbojets, second by ducted fan turbojets and third by nuclear engines, all using the same airframe.

Funding Plan

Martin said development and procurement could be funded within present budget levels and from funds now being spent for sea and land transport that SeaMistress would replace.

Production could begin within 24 months and cost of production models would be an estimated $5 to $5.5 million, roughly that of P6M or B-58.

Draft of the SeaMistress fully loaded would be 8.5 ft. Extensive studies of water areas of the world which could handle the SeaMistress show an availability of 15 to 1 over airfields in 43 countries with whom the U. S. has defense commitments. These could be served logistically if only England, Japan and North Africa were available as SeaMistress bases, Martin believes.

Water based air logistics proposal was presented as a concept, with SeaMistress as a "rubber design" comprising the heart of a complete system, including basing and ideas for freeing rivers and lakes of ice.

SeaMistress is capable of landing in 10-ft. waves or on 4 in. of snow, and system concept includes plan for clearing ice from water areas in temperatures down to —40F, Martin said.

Martin believes 100% of the personnel and 5% of the equipment now shipped by sea should be moved by air logistics. SeaMistress can accommodate largest piece of military equipment existent—Army's atomic cannon.

P6M Tanker

Baltimore—Prototype P6M SeaMaster probe and drogue refueling equipment will be built by Flight Refueling Inc., for Martin Co. and installed on an early model for tests. P6M will be able to transfer or receive nearly 10,000 gal. at "the most economical speeds and altitudes," Flight Refueling said. SeaMaster rotary mine door, which now carries mine or camera pod interchangeably, also will take refueling equipment as a removable mine door-pod.

Briefings on SeaMistress concept have been made over past few weeks to industry trade associations and defense and congressional aides, including White House military aides. Further briefings are planned for higher defense and congressional echelons and for steamship companies and airlines.

Roadblocks

Citing recent congressional testimony on the lack of adequate strategic airlift, including cancellation of USAF-Douglas C-132 project and lack of any Fiscal 1958 funds for USAF's Douglas C-133, Martin's advanced design project engineer Guy Mallery said three "roadblocks" prevent Defense Department from accepting and implementing water based logistics concept:

• **"Pressure on Department of Defense** and Congress from the commercial airlines not to fly airlift" that appears to compete with airlines. Mallery pointed out that the SeaMistress would be "four times too large for the airlines to use but the bare minimum for military requirements." He said it should no more be designed with commercial possibilities in mind than a tank should be designed to double as a taxicab. Mallery believes 10 SeaMistresses would have the airlift capability of the 900 military and civilian reserve transports now available.

While land based aircraft should continue to serve zone of the interior and non-combat zones overseas, water

based aircraff can be used to serve combat zones where fields do not exist or are destroyed early in a war, and in areas where troops are needed so quickly that there is no time to build airstrips.

• **Divided responsibility** within Defense Department. Although Army and Marines have great need for airlift and have shown interest in SeaMistress concept, Air Force has the budgetary responsibility to provide it and Navy has development, procurement and operational responsibility for seaplanes.

• **Misconceptions on cost** and capability.

Purchase of land based planes must be superimposed on other logistic costs, Mallery said. But water based airlift would replace "any transport means which cannot survive or perform under modern combat conditions"—surface shipping for personnel and overseas road, rail and pipeline movement of all cargo into the combat zone. Savings of $150 million could be achieved in the Military Sea Transport System alone, Mallery said.

Lockheed Offers C-130B to Civil Lines

PAYLOAD of one Hercules flight included 21 turboprop engine gear box shipping containers (shown above), 2,100 lb. of T56 engine parts, 500 lb. of tiedown chains—total, 14½ tons. Load was lifted from Marietta, Ga. to Indianapolis, Ind.

MOCKUP of flight deck of commercial version of Hercules is demonstrated at Lockheed Aircraft Corp.'s Marietta, Ga., plant. Compartment contains two bunks, hot meal galley, stowage space, toilet facilities, soundproofing and insulation.

Marietta, Ga.—Lockheed Aircraft Corp. announced today it will make its first bid to enter the rapidly growing air freight market with plans to offer a civilian version of the Hecules C-130B troop and cargo carrier to the airlines as an all-cargo, turboprop commercial transport.

The air freighter, which will be the first commercial plane to be produced at Lockheed's Georgia Division, will be introduced into the commercial market with an intensive sales campaign. Robert F. Stroessel has been appointed Hercules commercial sales manager.

Stroessel, former manager of sales engineering at the Georgia Division, will begin his campaign next week at the 13th annual conference of the International Air Transport Assn. in Madrid, Spain.

1960 Delivery

Operating and performance characteristics of the commercial cargo plane are the same as in the USAF C-130B (AW Aug. 12, p. 36) recently introduced as an improved version of the C-130A (AW Dec. 3, p. 50). The commercial version will be designated Lockheed's production model 282A.

Best estimated cost of the aircraft is in the "low $2 million category." Delivery date has been set for 1960. The plane will be powered by four Allison 501-D22 turboprop engines rated at 4,050 eshp. each.

Lockheed's decision to introduce the C-130B as a commercial cargo plane is based on the increasing volume of air freight which, the manufacturer says, climbed almost one-third during the first six months of 1957. Lockheed's commercial backlogs, centered in the California Division, represented 29% of the company's total during the first half of 1957.

In its recently published 10-year report, Air Cargo Inc., a corporation wholly owned by the scheduled airlines, said revenue ton-miles handled by the carriers had increased from 38 million in 1947 to 434 million in 1956.

The report admitted the majority of air freight moved by the scheduled airlines is currently handled on passenger aircraft but added that scheduled all-

cargo services operated with exclusive cargo aircraft are "more flexible in the handling of freight."

Most airline cargo officials feel there is a market for a cargo aircraft such as the one being offered by Lockheed. They point to the trend toward the purchase of larger aircraft by the airlines for exclusive cargo use instead of resorting to outmoded C-46s or C-54s.

Both American Airlines and United Airlines are operating DC-6A equipment on all-cargo schedules and Flying Tigers recently attributed a sharp increase in gross revenues to its new fleet of 12 Lockheed 1049H Constellations (AW Aug. 26, p. 45).

Straight-in Loading

Lockheed claims the air freighter is the first U.S. commercial plane to incorporate "straight-in," truck and dock-level loading facilities. The aircraft has a cargo floor only 41 inches off the ground and is equipped with an integral tail loading ramp 9½ ft. long and 10 ft. wide. The ramp can be lowered for drive-on cargo loading from the ground or can be used from docks. Aft opening of the air freighter is 10 ft. wide and 9 ft. high.

A forward door, 6 ft. 7 in. wide by 6 ft. high provides additional loading and off-loading facilities.

The plane will have a payload of 22 tons for a non-stop distance of 1,750 statute miles with normal fuel reserve or a payload of 16 tons on ranges of 3,000 statute miles.

Cruising speed of the aircraft will be approximately 350 mph. at altitudes to 30,000 ft.

The aircraft can be quickly converted to ski-and-wheel operations for cold climates and has been classed as a "high performer" off high-altitude airports. It can be backed into position under its own power and can be turned in its tracks by means of a steerable dual nose wheel.

Propeller Change

The plane will be equipped with 13½ ft. four-bladed propellers instead of the 15 ft. bladed propellers used on the C-130A. Fuel capacity is 6,900 gallons.

Lockheed feels that the aircraft and engine will have undergone considerable operating experiences by the time the first commercial delivery is made. At present, flight hours accumulated on the C-130As are approximately 15,000.

Several meetings have been held with the Civil Aeronautics Administration to discuss design features of the airplane. CAA officials have witnessed static tests and structural fatigue tests of the C-130A. According to a Lockheed spokesman, the manufacturer expects the tests to provide a good background for the certification proceedings for the 282A air freighter.

Hybrid IRBM Fight May Fall Into Management, Not Technical Fields

By Philip J. Klass

San Francisco—Divergent service philosophies on the best approach to managing development of an intermediate range ballistic missile may prove a more serious barrier to evolving a hybrid IRBM than the technological differences between the Army's Jupiter and the USAF's Thor, statements here by top Army and USAF officials indicate.

Secretary of Defense's recently formed three-man IRBM committee, which meets early this month to consider technical feasibility of a hybrid "Thorpiter," consists of William H. Holaday, Defense Secretary's special assistant on guided missiles; Maj. Gen. John B. Medaris, chief of Army Ballistic Missile Agency, and Maj. Gen. Bernard A. Schriever, chief of USAF's Ballistic Missiles Division.

Gen. Schriever, in San Francisco to address the Western Electronic Convention, said "there is no basic difference between the Jupiter and Thor." Both IRBMs use North American Rocketdyne powerplants, pure-inertial guidance systems and both have combination radio-inertial guidance systems under development for possible backstop purposes, Gen. Schriever said. Major difference, according to Gen. Schriever, is in "components." One example cited: Jupiter uses air-bearing gyros, Thor uses liquid-floated gyros.

Secretary of the Army Wilber M. Brucker and Gen. Schriever spoke at Wescon on separate days and neither made a direct reference to the Thor-Jupiter conflict. However, their speeches contained oblique references which point up the sharp cleavage in IRBM development philosophy between the two services.

Jupiter, which Brucker said is "slightly ahead of schedule," was cited "as a splendid example" of the advantages of the Army's philosophy of developing missiles in its own Redstone Arsenal, then turning them over to industry to produce. "When we turn a project over to industry, most of the guesswork . . . has been eliminated," Brucker said. "We have a good yardstick to measure acceptable performance. We know within narrow limits what the cost ought to be . . . how soon we should expect delivery."

Then, in a pointed reference to Air Force practice Brucker said:

"There is a philosophy of procurement which advocates contracting out virtually everything and putting upon industry the whole job of determining what should be supplied. This can lead to false starts, frequent modifications and unsatisfactory end items. Such procedures are wasteful, costly and time consuming."

Without mentioning Army's successful flights of Jupiter test vehicles, Gen. Schriever said a single or a few shots of a missile, built breadboard fashion by its inventors in a closely supervised model shop may be a satisfactory approach to illustrate a principle.

"The key problem is to organize the entire program so as to assure the efficient working out of all engineering details, some by theory and some by experiment, the attainment of reliability through a great deal of testing, and an industry capability to reproduce the results in the quantities required.

Therefore, we have held uppermost in our planning that production and operational capability are the real end goals of the development."

Without making reference to publicity on flight tests of Army experimental missiles, Gen. Schriever said the USAF missile tests resemble an iceberg in that only a small portion of the total is visible.

"Hundreds of flights may be needed to accumulate a single hour of operating experience," he said. "Attainment and proof of reliability can not rely alone on flight tests because of the enormous expense and relatively small amount of data obtained. Wherever possible, all subsystems must be brought to a high reliability by testing on the ground."

Crux of any satisfactory compromise on a hybrid IRBM, some observers believe, is the question of which service would manage the development and whether it would be carried out in Redstone Arsenal in traditional Army pattern or in industry under Gen. Schriever and Ramo-Wooldridge. To these observers the problem of evolving a hybrid "Thorpiter" appears far easier to resolve than evolving a hybrid Army-Air Force development-management organization and philosophy.

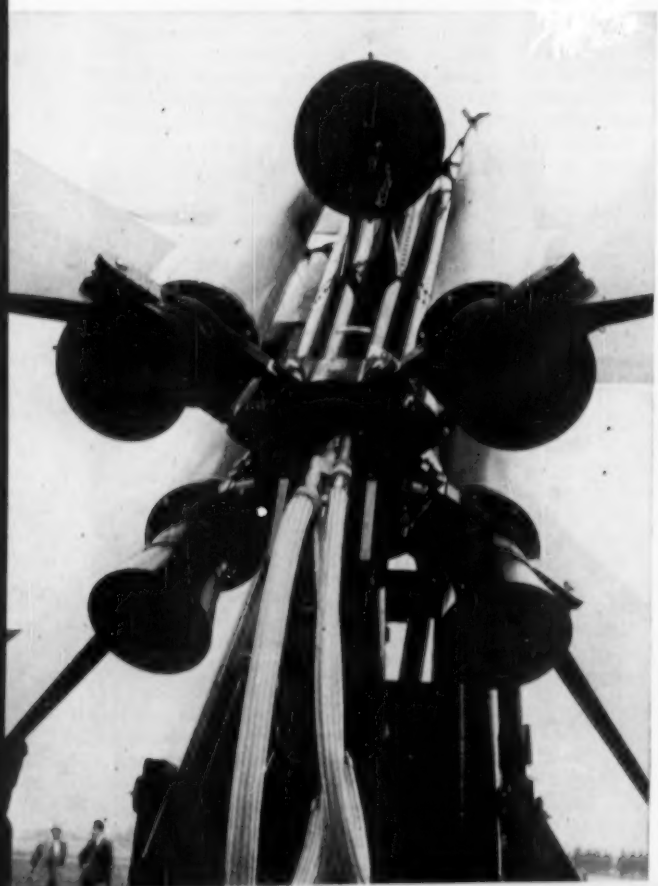
ICBM Defense

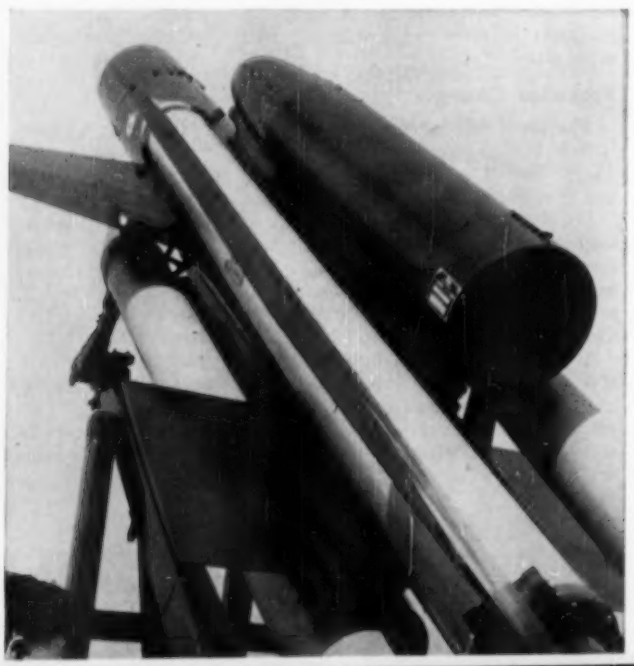
Three industry teams have completed military sponsored Phase I study programs on possible defense against intercontinental ballistic missiles and their reports are now under evaluation. Companies include: Convair-Radio Corporation of America, Lockheed-Raytheon, and Douglas Aircraft-Bell Telephone Laboratories (AW Aug. 19, p. 29).

Positioning of Bloodhound's four booster rockets, two ramjets is shown (top right). Weapon stresses simplicity.

British Bloodhound Displayed

Bristol Bloodhound ground-to-air semiactive homing missile is powered by two Thor ramjets with thrust estimated at 8,000 lb. each. Four solid fuel booster rockets are hinged at bottom from a common ring (below, left) and on separation rockets part outward from forward attachment point and fall behind with seating ring intact (AW Aug. 26, p. 28).





Heat Problems Limit Rocket Fuel Gains

Evanston, Ill.—Heat problems imply "a foreseeable end of the line for chemical propellants" in rocket engines if they are not solved, and similar problems will carry over into use of "high-energy propellants and nuclear type rockets," USAF Brig. Gen. Marvin C. Demler told an American Rocket Society meeting here last week.

Gen. Demler, Air Research and Development Command's deputy commander for R&D, said magneto fluid dynamics—or acceleration of ions—is now "looming large on the horizon in the realm of propulsion." He said there are "indications that herein might lie a useful tool for the ultimate propulsion of a rocket."

Gen. Demler used the work in magneto fluid dynamics to illustrate the importance of investigating basic physical phenomena and of recognizing implications of such investigations.

Further gains in range, speed and payload capability are possible through continued development of current rocket engine techniques, Gen. Demler said.

"But as long as we are dependent on increasing specific impulse, with its attendant problems of combustion, temperature and pressure, we are confronted with many barriers, such as the weight of working fluids, the high factors of acceleration, the cost of exotic fuels, the need for further understanding of combustion processes and the basic principles by which a heat engine operates."

Heat 'Barrier'

Heat, he said, is "one of the foremost barriers" in further development of chemical fuel rocket engines. "To make materials which will withstand much higher operating temperature we must try to strengthen the very basic lattice bonds of the materials and to do this we must explore the basic areas of material sciences.

"Failure in this attempt implies a foreseeable end of the line for chemical propellants."

Gen. Demler said the random manner in which particles released by combustion flow against walls of the combustion chamber is "a second barrier to optimum employment of chemical fuels."

Researchers found that ionized particles influenced by strong magnetic fields "could be directed and accelerated . . . and that using these magnetic forces to deflect the particles away from the walls of the chamber . . . prevented heat loss to the walls of the chamber," Gen. Demler said.

Advancing into use of high-energy propellants and "to the nuclear type rocket in which combustion temperatures may exceed 5,000F" will bring many unknowns in heat transfer and performance, Gen. Demler said.

"Extensive dissociation, ionization and recombination will create problems throughout the combustion and gas flow cycles," Gen. Demler said. "Catalysis and inhibition of dissociation, third body effects of chamber walls and/or wall coatings, or nozzle coatings could possibly have considerable effect on the amount of heat energy converted into translation energy—or effective thrust."

Although basic thermodynamic laws inherently limit heat engines, "we cannot completely discount this family of engines," Gen. Demler said. He called for further improvement of "this type of energy release to insure our continued leadership," but he also said greater propulsion research effort and greater exchange of information between scientists and Air Force are needed.

Environmental Energy

In addition to further investigation of chemical energy and nuclear energy from fission or fusion, Gen. Demler said, "We must explore the utilization of environmental energy, the energy of the sun and the energy of the concentration and distribution of ions, atoms and free radicals existent in the earth's atmosphere" in attempts to harness them for propulsion.

Gen. Demler also said ARDC's Research Planning Objective Documents, which will outline USAF's areas of scientific interest to industrial and educational research groups, will be ready for distribution later this year. The RPO corresponds in the research area to ARDC's Technical Program (Development) Planning Document in the area of technical requirements and development areas of interest. There will be one RPO for each of the six Air Force Research Program areas—propulsion, materials, electronics, geophysics, biosciences and aeromechanics.

Ionic Propulsion Research

Washington—At least five contracts for exploratory research into the possibility of ionic propulsion are being sponsored by Air Force Office of Scientific Research. More are being negotiated.

Significance of AFOSR program is that after three decades of theoretical studies, ionic propulsion now is the subject of active, sponsored research, with attempts being made under some of the contracts to achieve thrust on a laboratory scale.

Contractors include Avco Manufacturing Corp., fundamentals of magneto hydrodynamics; Rocketdyne Division of North American Aviation Inc. (AW April 8, p. 27); Giannini Inc., and linear accelerator studies at University of Utah and Armour Research Foundation on particle acceleration and high velocity impact.

Other companies that have shown interest in ionic propulsion possibilities are Convair Division of General Dynamics Corp. (AW Mar. 4, p. 104) and Aerojet-General Corp.

Estimates of rocket speeds attainable with ionic propulsion range as high as Mach 5,000 and estimates on specific impulse possible have ranged up to 300,000 sec., but there still is wide disagreement.

Ionic propulsion system would obtain thrust by electromagnetically accelerating streams of charged particles (AW Nov. 26, p. 57). Drawbacks include need for a great electrical power source; fact that thrust is low, although attainable over a long period of time; and need for conventional power for operation in earth's atmosphere.

Atom Rocket Engines Studied by Lockheed

Sunnyvale, Calif.—Nuclear propulsion for missiles is under serious investigation at Lockheed Aircraft Corp.'s Missile Systems Division.

Dr. Louis N. Ridenour, assistant general manager for research and development, said a three million volt Van de Graff positive ion accelerator will be used in investigations of the possibility of nuclear propulsion. The accelerator, largest in use in the aircraft industry, went into operation last week at the Lockheed Nuclear Laboratory at Stanford University's Industrial Park, Palo Alto.

The accelerator produces nuclear radiation under controlled conditions, permitting great accuracy of measurement. Hydrogen or helium nuclei will be used to bombard targets. Dr. R. D. Moffatt will direct the work.

Fields to be investigated include nuclear structure, reactor design, radiation shielding design and material damage.

The accelerator will be made available to neighboring scientific organizations on a commercial basis. It is the

first of its type to be used on the West Coast. The 2,500 sq. ft. accelerator room is surrounded by three ft. concrete walls. A large pit beneath the target prevents reflection of neutrons from the floor. Control room is 500 sq. ft. The laboratory also contains a radiation-proof work cell near the accelerator room where natural or artificial radiation sources may be removed from containers by remote control to expose materials for study purposes.

Aero Design Facility Destroyed by Fire

Bethany, Okla.—Main production facility of Aero Design and Engineering Corp. was destroyed by fire last week. Damage is estimated as $3 million, including seven Aero Commanders which were on the production line when the plant burned.

Aero Design will shift production work to its new plant nearing completion across the airport from the burned facility. Aero Design President R. T. Amis, Jr. said the company will conduct business as usual and there will be no interruption in company operations or the manufacture of spare parts for Aero Commanders.

Production facilities will be established on an expedited basis in the new plant, and the company hopes to start rolling new Commanders out in 90 days. The new building is two thirds finished and will be completed within six weeks. Amis said Aero Design has 50 aircraft in its production pipeline.

Senate Group Attacks USAF Procurement

Washington—Procurement of weapon systems through prime contractors damaged small business and USAF has not been effective in its effort to combat more in-plant work by primes, a Senate committee charged last week.

The Senate Small Business Committee acknowledged that USAF is trying to make weapon system contractors stay in their own backyards and rely on a subcontracting structure that includes a fair share of companies employing fewer than 500 persons.

But, its report concluded, in this and other areas Department of Defense officials "who dictate procurement policy have failed to convince their contracting and technical personnel that when they publicly state that they want to help small business they mean exactly that."

The committee headed by Sen. John Sparkman (D.-Ala.) cited the case of a small business firm that saw its business with the Air Force decline from $1.38 million in 1953 to $20,000 in 1956 and to nothing in 1957. The company was told USAF no longer purchased his product and that he should sell it to the prime contractors. Solicitation of business from 63 prime contractors aroused no interest.

The report said this case "indicates less than wholehearted support of the Air Force subcontracting program on the part of weapon system and other prime contractors."

It was suggested that the Small Business Administration be allowed to approve or disapprove applications for accelerated tax amortization on new plant facilities when these facilities might result in loss of contracts to competent small business firms.

The committee's emphasis on alleged failure of contracting and technical personnel to carry out the edict of their superiors on protection of small business interests came at a time when protests against this situation are mounting.

Current slowdowns and cancellations of USAF contracts, forced by Pentagon budget austerity, are resulting in more complaints from small business firms that prime contractors are trying to pull former subcontract work back into their plants. It is anticipated that the situation will get worse as prime manufacturers feel the pinch more severely and are faced with personnel layoffs and surplus facilities.

The committee recommended that the Air Force survey all its prime contractors to find out exactly what components have been removed from the subcontract structure. It also expressed concern over USAF figures showing the amount of prime contracts held by small business firms as of Dec. 31, 1956, was only $560 million, 1.3% of the face value of all USAF contracts.

Also under fire in the report are USAF testing methods and alleged nonadherence to published regulations covering Qualified Products Lists. The committee found that "inherent complexities" and "sophisticated use" of such things as the QPL and the weighted average pricing formula "serve to thwart small business men and to justify a strong preference for large suppliers through plausible, though unsubstantiated, references to 'purchasing efficiency' and 'national interest.'"

Reds Visit Wescon

Visit of 16 Soviet scientists to recent Western Electronic Convention (Wescon) in San Francisco, prior to attending International Scientific Radio Union meeting in Boulder, Colo., created significant impressions upon both hosts and visitors.

- **Soviet visitors were deeply impressed by magnitude of U. S. electronics industry as evidenced by the 600 company exhibits and more than 10,000 engineers in daily attendance at Wescon. At Russian Popov Society conference, recently visited by four U. S. scientists, there were no formal exhibits and attendance was around 1,000—many of them engineering students from Moscow University.**
- **U. S. hosts were impressed by competence of visiting Soviet scientists and their command of the English language. Although not scheduled to deliver any papers at Wescon, three of the visitors prepared on the spot and delivered highly theoretical papers in English dealing with information theory, molecular amplifiers (Masers) and ultrasonic waves in liquids. Papers were delivered at a specially arranged evening session.**

Lockheed Layoffs

Total employment at Lockheed Aircraft Corp. will fall from a mid-August total of 61,900 to 55,700 by the end of the year because of aircraft procurement economies, the company has announced. Reduction in force will be brought about by "normal terminations and layoffs." No mass layoff is foreseen.

Breakdown of reduction by division is:

- **California Division, from 32,000 to 28,000.**
- **Georgia Division, from 18,000 to 16,500.**
- **Subsidiaries, from 5,200 to 4,800.**

Reductions are partially offset by an increase in the Missile System Division from 5,400 to 6,100. The corporate group will increase by 300.

House Group Criticizes Boeing, Air Force

Washington—House Armed Services Committee criticized Boeing Airplane Co. and the Air Force last week for what it termed failure to evidence "any enthusiasm for or interest in" the recapture of $5 million excess profits on a subcontract with the Ford Motor Co. for B-47 wing sets.

General Accounting Office testified that Ford volunteered the refund but that Boeing was reluctant to accept it and that USAF did not properly press a contract repricing (AW April 8, p. 37). "The position of the Air Force in this transaction is unusual," the committee declared: "$5 million of savings scarcely got five cents worth of attention from higher echelons."

Noting that Boeing has protested that this was a misinterpretation of its attitude, the committee commented: "If the severity of the judgment of the American public has been visited upon these parties we think it earned by their conduct. . . ."

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Resale Market Softens at Critical Time

With airlines facing major equipment shift to jets, prospect of used aircraft oversupply looms.

New York—Trunk airlines, in the midst of their costliest re-equipment programs, face an uncertain market for their used transports.

What has been a seller's market for almost a decade shows signs of leveling off.

Planes are getting a little harder to move, and some prices are off compared to a year ago.

If the market is flooded during the next few years with obsolescent piston aircraft as new jets and turboprops begin arriving in quantity, plummeting prices will add to the trunklines' financing woes.

Whether this happens or not, the balmy days when almost any used transport was snapped up at a premium are over.

Newer Types

The DC-6, Constellation and pressurized twin-engine types that should be coming on the market soon in greater quantities than ever before are still selling high—in most cases, higher for clean used planes than they cost at the factory. Later-model pressurized airplanes still rarely available secondhand are farther in the future of the retirement picture.

To dispose of the next round of aging planes, as well as remaining DC-3s and DC-4s, the airlines are going to have to price them more realistically than they have.

As of today, prices still reflect a seller's market. Estimated current top values for zero time since overhaul of used transports, when and if available, were provided by William C. Wold Associates, New York aircraft broker (see box right).

Buyers for a Stratocruiser or 049 Constellation are notably scarce. A soft spot in the present market is the nonpressurized DC-4, its obsolescence increased by large-scale deliveries of late-model transports.

Examples:

• **Slick Airways** has had seven DC-4s on the block for several months without being able to move them. Prices average in the $400,000 range. Slick plans to intensify its sales efforts, perhaps negotiating prices.

On the other hand, Slick recently sold a DC-6A to Alaska Airlines and got a premium.

Slick recently set up a separate division to handle aircraft sales (AW July 29, p. 45).

• **Flying Tiger Line** sold eight DC-4s recently, all of them to foreign carriers. It reports good prices for the aircraft, but worked hard to find the customers through advertising, listings with brokers, direct contact by a full-time Flying Tiger representative handling sales of the DC-4s and five C-46s. All C-46s sold, four to a foreign government.

• **Western Air Lines** disposed of its two DC-4s to a Brazilian airline. Western won't reveal the price, but reports a softer market for the DC-4 than for the DC-3.

• **Eastern Air Lines** recently sold a DC-4A, with 6,000 hr. since major overhaul, to Pacific Southwest Airlines for $262,500.

Softening DC-4 market is still active. Wold reports sales by his organization of three of these planes within past 60 days, one to a Canadian mining corporation for $450,000 with about 1,200 hr. since overhaul.

Highest prices ever paid for DC-4s, Wold says, probably were those paid during 1952 when two went to Japan Air Lines and one to Thai Airways at prices related to a zero-time base of $750,000.

What the market for used transports will be in the next few years depends, on supply and demand. Supply will depend on what the big carriers do with their piston equipment.

If traffic increases sufficiently to absorb most of the new capacity of expanded fleets, carriers can release their older equipment more gradually.

Eastern Air Lines President Thomas F. Armstrong recently predicted to the Civil Aeronautics Board, however, that delivery of new aircraft capacity to U.S. flag air carriers within the next four or five years ". . . will certainly result in flooding the aircraft market to an extent probably never known before, not even in the immediate post-World War II period when there were considerable numbers of DC-3s and DC-4s available."

Plans Formulated

Only Eastern and American Airlines, among the Big Four, have any formal plans for beginning the retirement of sizable amounts of present equipment:

• **Eastern** has sold most of the inventory it acquired by merger with Colonial Airlines. Eight DC-3s have been sold along with three DC-4s, leaving two DC-4s to be sold. Market for the latter aircraft is still "pretty good," Charles Froesch, vice president-engineering, told AVIATION WEEK. Sales began last November, and by this November Froesch expects the inventory to be sold out.

Eastern is sounding out potential customers for its Constellation 749s. Froesch expects to sell them all by next spring when delivery of the airline's DC-7Bs is completed. The 749s will be priced at about $1 million.

As to Eastern's twin-engined Martin 404s, Froesch says the airline will continue to use them for some time, four

Used Transport Prices: Going Down

Prices of used transport aircraft, as of today, still reflect a strong seller's market, but the trend is down. Following estimated top values of used planes with zero time since overhaul, when and if available, were provided by William C. Wold Associates, New York aircraft broker.

	Year Ago	Today	Average New
DC-3	$175,000	$135,000	$125,000
DC-4	550-575,000	450-475,000	475,000
DC-6	1.5 million	1.35 million	860,000
L 049	1 million	900,000	625,000
L 749	1.25 million	1.1 million	1 million
B-377	1 million	900,000	1-1.25 million
CV 240	500,000	400,000	275,000
CV 340	650,000	550,000	575,000
M 202	350,000	250-300,000	290,000
M 404	500,000	400,000	535,000
C-46	150,000	125,000	

or five years at least. Eastern sees nothing yet to replace the 404s.

Eastern also is considering retirement of its 1049 Super Constellations, but hasn't decided exactly when.

Later disposal of piston planes will depend on the success of the jets and turboprops, in Froesch's view.

• **American** is releasing 10 Convair 240s pitching its sales efforts to the corporate market. None has yet been sold, an American spokesman said, although general interest has been shown and there are several prospects.

American expects no difficulty in disposing of the ten airplanes during the year.

Price of the 240s is $375,000 each with newly overhauled engines, which American says is equivalent to "a bit less than $350,000" in an as-is condition. When compared with the price of the 340 and other aircraft in this class, the 240 price is reasonable compared with the market, American says.

American also plans to sell two DC-4 airfreighters within the year as three new DC-6As are delivered. American may have a few DC-6s for sale as older aircraft of this type are replaced with specially-configured Royal Coachman DC-7s.

Unsold Aircraft?

As of now, it is impossible to predict that all piston airplanes which may be available within the next two to three years will be sold, according to American. The market, the carrier feels, will have to firm-up considerably to warrant the conclusion that all of the planes can be sold.

Armstrong told CAB that "while the equipment shortage probably is not yet completely over, certainly current production and the future production of turbine-engine aircraft capable of carrying more passengers at higher speeds will change conditions from a seller's market to a buyer's market, with the concomitant reduction in seller's prices."

What will be the demand for used transports in the near future?

Potential customers for the trunkline castoffs will fall into four major categories, as they have in the past:

• **Foreign carriers.**
• **Domestic feeder** airlines.
• **Irregular and cargo** carriers.
• **Corporate users.**

Foreign Sales

Sales to foreign carriers—not the big, modern competitive airlines but those in relatively undeveloped areas—offer possibly the best hope for disposal of older American transports. The DC-4 market is a good example.

According to Wold, about half of used DC-4 sales were to foreign buyers until five years ago, and the trend has been increasingly toward that market since. More than 75% of DC-4s now go to foreign carriers, Wold estimates.

To keep selling to the foreign market, American carriers may have to relax their cash financing terms, which they will be reluctant to do.

Froesch said Eastern would rather cut the price of a plane than sell it on time, particularly to a foreign carrier unless payment were guaranteed by a New York bank.

For a U.S. customer, Eastern might help find financing but wouldn't handle it direct.

Feeder Market

Market for used trunkline equipment among the domestic feeder airlines appears to have a limited future. Many local service lines are considering a move directly from the DC-3 to new turboprop aircraft; several of the lines already have ordered Fairchild F-27 Friendships.

New legislation now being cleared in Congress is expected to make it easier for feeders to finance the new equipment (AW July 1, p. 43).

In Aviation Week discussion of equipment with local airlines, little interest was expressed in used aircraft. Prices will have to be extremely attractive to stir interest. Examples:

• **Central Airlines** has 13 DC-3s, no plans to buy or sell any now, although more DC-3s may be added in the future. When the switch to new equipment is made, President Keith Kahle says Central will go to a turboprop, probably the F-27. Convairs and Martins are out.

Kahle laid stress on the guaranteed loan bill as an aid in financing new equipment.

Kahle said it isn't hard to finance DC-3s, but very hard to get money for new, expensive equipment because of the poor earnings records of local service airlines. Central's plans hinge definitely on some form of help from Congress, Kahle said.

• **Bonanza Airlines** has 10 DC-3s, expects to buy another this year, has ordered three F-27s for 1958 delivery. The carrier finds it easier to finance DC-3s than F-27s.

• **Pacific Southwest**, an intrastate carrier, has just bought a DC-4, plans no more buying now. President Ken Friedkin believes the answer to the question of new turbine equipment versus used piston types depends on the economics of a carrier's routes and traffic as related to a particular airplane rather than on the price difference. Financing, he points out, is not affected so much by the airplane's newness or age as by the relationship of cost and prospective profit.

• **Piedmont Airlines** has ordered 12 Friendships, optioned 12 more. Financing has not been completed, and some of the current legislation is "vitally important" to Piedmont's financing program, according to C. G. Brown, assistant vice president traffic.

Piedmont seriously considered buying Convair 240s, 340s, new 440s, or Martins, Brown said. But from operating experience of other carriers, Piedmont decided these types could not be operated over its routes without subsidy. The F-27 with 36 seats, Brown said, is expected to break even over Piedmont's routes with a load factor of about 60% and get the airline off subsidy.

Brown emphasized that what might be true for Piedmont might not necessarily be true for another local service carrier with a different route structure. Piedmont's area is characterized by mountainous terrain, relatively little competition from ground transportation, low-density traffic. Friendship's short-field abilities, ground handling flexibility because of its high wing made it suitable for this pattern.

Load Factor

Piedmont figures an 80% breakeven load factor for its DC-3s.

• **Mohawk Airlines** operates 11 DC-3s and 11 Convair 240s. The airline paid about $400,000 each complete for the 240s, according to President Robert E. Peach. Mohawk operated the Convairs with 46 seats at a breakeven factor of about 50%, Peach said. They are used on the 60% of Mohawk's route pattern that Peach says is of a high-density nature and competitive with trunk carriers. Other segments are operated with DC-3s, which gives the airline a split fleet requirement that Peach calls unique among local service carriers.

In choosing the 240, Peach said, he was not concerned with new versus used equipment but only with Mohawk's specific needs. In 1955, the F-27 was several years away and delivery of the Convair 440 was about 18 months away. Range advantages of the 340 and 440 were of no use to Mohawk anyway with its 180 mi. average segment.

Replacement Plans

Mohawk plans no fleet replacements for the next several years, Peach said. In the early 1960s, DC-3s will be replaced, perhaps with the F-27.

Mohawk's president sees little value in the guaranteed loan bill, says local service lines' financing depends on the ability to show decent earnings in the next couple of years. Key to this, Peach said, is a change in CAB mail pay policy that would allow "fair return."

• **Trans Texas Airways** has made no decision on what transport will replace its DC-3s. Carrier operates 20 of these aircraft, plans to buy three more if

Jetstar to Fly This Week

Lockheed Aircraft Corp.'s prototype of its Jetstar utility transport rolled out last week at company's Burbank plant. The 10-passenger, 500 mph. twin-jet transport's development time was only 30 weeks, Lockheed reports. First flight of the plane is scheduled this week.

new routes are awarded in a pending CAB case.

• **Ozark Air Lines** plans definitely to buy new turbine equipment when re-equipment time comes.

• **West Coast Airlines**, Southwest Airways, Mackey Airlines, and Frontier Airlines have ordered a total of 15 Friendships.

As far as the all-cargo lines are concerned, trend is toward new equipment. Flying Tiger has leased two 1049H passenger-cargo Super Constellations and has bought 10 new 1049Hs. Slick is buying eight new DC-6As. The C-46 is still providing feeder service for both carriers. Seaboard and Western has bought five 1049Hs.

Flying Tiger reportedly is interested in a cargo version of the DC-7, which would be purchased new.

Where cargo lines in the past have found DC-6As rarely available and then at prices higher than new-plane price, deliveries are now catching up and it is to their advantage to buy new equipment unless prices go down. Second-hand aircraft such as the passenger DC-7, even at reduced prices, wouldn't offer the operating economy to a cargo line of the DC-6A.

Financing Trend

Flying Tiger Line reports, however, that it is at least as easy to finance used equipment as new equipment if a bank thinks the price is reasonable.

Irregular carriers now operating the DC-4 appear to be logical customers for such aircraft as Eastern's surplus 749s, but not at the inflated prices of the past. Usefulness of the DC-4 to the contract carrier has been lessened not only by its general obsolescence but by government requirement that pressurized equipment be used for all overseas contract passenger flights.

Financing will be difficult for many of these carriers unless the price of later-model transports comes down.

Corporate Market

Final major market possibility, the corporations, can be expected to absorb a part of the twin-engined used transport supply, but how much is problematical. Price is going to be the big factor.

Wold thinks sales and charters to industry will take care of the Convair market within the next two years, providing the price comes down to the neighborhood of $175,000, so that with conversion to executive configuration the cost will be around $325,000.

A broker in the Texas area foresees a corporate market for about 25 Convair-type transports in the next 18 months. A Southern California broker sees little chance in his area for corporate sales of this type of plane. He said the greatest demand is for new aircraft designed for executive use, such as the light-twin. Another West Coast broker reports the same situation.

Corporations have ordered a total of 14 F-27s, illustrating another area of competition for used transports.

The matter of used trunkline aircraft sales received considerable attention during recent CAB hearings in the Suspended Passenger Fare Increase Case, during which seven trunk carriers asked for a 6% emergency fare increase.

One aspect of the case concerned a new aircraft depreciation policy recommended by the Bureau of Air Operations, which would set up a seven-year service life and a 25% residual value for equipment in calculating profits.

Carriers have been using a 10 or 15% residual value, and a Bureau witness, Harry H. Schneider, chief rates division, testified in part:

". . . The depreciation allowance which the trunkline carriers have been charging for post-war piston engine equipment in the past several years has borne little, if any, direct relationship to the actual depreciation expense. . . . At the present time, to the best of my knowledge, there is no indication that the market for modern piston engine aircraft will change significantly. . . ."

Airline Practice

As a basis for this, Schneider referred to "the industry's own optimism regarding the value of used aircraft in the next several years" as expressed in the capital gains proceeding.

In this proceeding, a consultant representing the carriers involved stated that "prices to be received for equipment retired are estimated at 80% of the current market values. . . ."

Schneider also testified that he had no knowledge from the forecasts and records of the airlines as to firm plans to retire any large numbers of aircraft in the next two years.

Airlines, protesting the recommended boost in residual value percentage, painted a gloomier picture at the fare hearing. Besides Armstrong's statement and others, a Braniff brief spoke of increasing obsolescence rates of piston aircraft and asked a question which many people would like to see answered.

"What will supply and demand be and how long will the tight used aircraft market brought on by post-World War II demand and the Korean crisis exist?"

Soviet Tu-104 Transports to Visit U. S.

Washington—In another move to impress the western world with its prowess in the air transport field, the Soviet Union next month will fly its United Nations delegation to the U. S. in two Tupolev Tu-104 twin-jet transports.

Last week, State Department handed to the Charge d'Affaires of the Soviet Union a note approving a Russian request to land the swept-wing, turbojet transports on U. S. soil.

The aircraft will be the fifth foreign-made, turbine-powered transport to visit the U. S. since the first Capital Airlines Vickers Viscount turboprop landed at Idlewild on June 24, 1955.

Port Authority Stand

Whether the Port of New York Authority will lift its ban on jet transports to permit the use of International Airport by the Soviet transports was still uncertain late last week. The Port Authority pointed out when queried by AVIATION WEEK that its long-standing prohibition against the landing of jets at New York and New Jersey airports under its jurisdiction was still in effect and would apply to the Russian planes.

A Port Authority commission resolution of July, 1951, declared that no jet planes may land at Port Authority airports without permission. Various jet aircraft of American make, including the Boeing 707, have been refused permission to use International Airport.

Only the French twin-jet Caravelle transport, whose noise characteristics were tested and said to be no greater than that of a large piston engine aircraft, has been given permission to use a Port Authority airport. When asked if the noise level of the Tu-104 were known, a Port Authority spokesman answered, "No."

Russia apparently is leaning heavily on the Tu-104 as a propaganda and prestige vehicle. Three of the jet transports were recently assigned to operate from Prague to Cairo, Beirut and Damascus over the routes of Czechoslovakia's state airline, CSA, on a regular weekly basis to accommodate the increasing flow of Russian and Czech military technicians, industrial experts and traveling salesmen moving into Egypt and Syria.

Earlier, Tu-104s have been used to fly the Bolshoi Theater Ballet to London and the Russian Olympic team to Rangoon en route to Australia. During the Khrushchev-Bulganin visit to London last year, three of the aircraft were operated into England to perform courier service as well as to transport the two Communist leaders to and from Moscow. The aircraft was one of the main attractions at the recent Paris air show (AW June 10, p. 26).

The prototype Tu-104 was first flown in 1955, and the Russians have since boasted of their jet transport lead over the U. S. and other countries. Larger turboprop and turbojet transports also have been announced by the Soviets (AW July 22, p. 26).

The Tu-104 is not an aircraft suitable for a long-range transatlantic hop because of its limited range (2,000 miles). This restriction cut the Olympic team's jet trip to Australia short at Rangoon and may require Russia's United Nations delegation to cross the Atlantic in easy stages.

However, it is possible that range will be increased for the U. S. trip by increasing the fuel capacity of the aircraft. Under the arrangement with the State Department, the two aircraft will stop en route at Gander, Newfoundland.

U. S. Navigators

In its request to make the flights, the Soviet government asked that American flight personnel board the aircraft at Gander to navigate the two planes over U. S. territory.

Civil Aeronautics Administration has arranged to have air traffic control experts available for the job of handling communications and navigation aboard the Russian planes from Gander into the U. S. The U. S. technicians will not handle the controls of the aircraft but will act as advisors in bringing the aircraft into U. S. airways and to the airport selected to accommodate the planes.

The Russians asked for permission to land at Idlewild or "some other air field in the New York area." If the Port Authority refuses to grant permission to the Russians to use Idlewild, the planes may be diverted to Mitchell AFB or Floyd Bennet Field.

By late last week, the Port Authority had received no request from the State Department to make an exception to their six year old ruling. Meanwhile, the Civil Aeronautics Administration had no comment to make on the issue after being closeted with the Air Force and State Department in a day-long session held to discuss the problems posed by the Russian visit.

State Department Stand

The State Department explained its reasons for granting permission to the Russians for the flight as follows:

"In the past, U. S. official delegations, including that of the 1947 foreign ministers conference, have been permitted to fly to Moscow in U. S. aircraft, and since the war, the Soviet government has consistently approved flights carrying the U. S. ambassador to and from Moscow."

The State Department said the Soviet delegation to the U. S. is large enough to justify the use of two planes. According to the schedule, one Tu-104 will land in the U. S. sometime between Sept. 3 and 7; the second flight will be scheduled to arrive about Sept. 13.

Foreign-made turbine-powered transport aircraft which have operated into U. S. airports are the Vickers Viscount, Bristol Britannia, Caravelle and the de Havilland Comet IIA.

Tu-104 Boosts Traffic

Moscow—Tu-104s, which were placed into scheduled service less than a year ago (AW Oct. 29, p. 43), already have become a significant factor in boosting traffic on Aeroflot, the Soviet-owned airline. The jet transports are now reportedly carrying over 10,000 passengers monthly on long-haul domestic and international routes, and the airline may book its 50,000th Tu-104 passenger in September. During the first six months of 1957, the Russian carrier handled 50% more passengers than in the same 1956 period.

Midatlantic Route Awarded PanAm

Washington—First midatlantic U. S. route for an American carrier was granted Pan American World Airways on a temporary basis by the Civil Aeronautics Board last week with the approval of President Eisenhower.

The Board also certified Madrid as a stop on the airline's New York-South Africa route but turned down the airline's bid to compete with Trans World Airlines in serving Madrid on its North Atlantic route.

The new midatlantic route will link Miami, San Juan, Madrid and Rome. The authorizations granted Pan American are effective until July 4, 1959, at which time the Board will survey the results of the operation.

The Board said in its decision that it found no need for additional service to the Spanish capital on the North Atlantic route and added that the granting of Pan American's request to operate New York-Madrid direct would interfere with the competitive balance between the two U. S. airlines. The Board termed Madrid traffic substantially below that of other major European cities where the two compete.

The Board pointed out that until its

decision Pan American's only participation in the Puerto Rico-Europe market was confined to the circuitous routing via New York. The new direct service from Puerto Rico to Madrid will permit the airline to compete directly with Iberia, the Spanish airline, and Avianca, the Colombian carrier, both of which operate over the midatlantic route.

Under the new authorization, Pan American will be permitted to serve Madrid from New York only on flights traveling the entire distance on its route between New York and South Africa. The Board reasoned that the route is one of the longest in international air transportation and, therefore, requires the Madrid stop to help make the route more self-sustaining economically.

During the hearings on the case, TWA argued that if a European stop is required, Barcelona, which is presently served by Pan American on its route to Rome, should be added rather than permit the carrier to enter the Madrid market.

The Board said, however, a Barcelona stop would be more circuitous and would not hold the stopover advantages of Madrid.

Celler Committee Recommends Antitrust Investigation of ATA

By Katherine Johnsen

Washington—The House Antitrust Subcommittee has urged the Justice Department to make an investigation of the Air Transport Assn. for possible antitrust violations. The recommendation was disclosed in the group's report made public today and based on extensive hearings held last year.

The subcommittee unanimously agreed that aspects of ATA's activities raise questions of possible antitrust law violations. However, the three-member Republican minority protested that the views expressed by the Democratic majority headed by Rep. Emanuel Celler (D.-N.Y.) were intemperate and "designed to depict ATA as an evil monster."

Republican Viewpoint

The Republicans, Rep. Kenneth B. Keating (N.Y.), William McCulloch (Ohio), and William Miller (N.Y.), declared:

"A number of ATA's practices raise antitrust questions which are proper subjects for examination. . . . The activities of the Air Traffic Conference in relation to agents, the operations of the joint airlines-military ticket offices and some of ATA's post-war activities in attempting to counter the operations and propaganda of potential new entrants into air transportation are examples. . . . If any of ATA's practices need to be restricted or eliminated, we are sure the Department of Justice will take the necessary action to do so."

After noting that "many of its functions result in valuable contributions to the industry and to the public," the Democrats said:

• **ATA has been "used** as an instrument to organize legislative campaigns for the industry which were designed to exert pressures upon the Civil Aeronautics Board in pending proceedings. ATA's activities in this respect were directed toward denial of operating authority to companies whose applications were then under consideration by the Board and appear to be an element in a combination to exclude competition that may be unlawful under antitrust laws."

• **Although questioning** ATA's "close working relationship" with CAB, the subcommittee added that "it is clear that regulation of commercial aviation has not been dictated by the certificated industry. Despite intensive campaigns to influence the Board's judgment and to prevent the entry of new competition, in all major cases the Board ultimately has ruled against ATA and the established industry."

• **Because of conflicting** testimony, the subcommittee said that "no conclusion" could be reached as to whether Stuart Tipton, then general counsel and now ATA president, persuaded CAB member Harmar Denny to change his position and vote to dismiss a fare investigation in April, 1953 (AW April 2, 1956, p. 93). It added that "conversations of this nature should not occur." The Republican minority complained that "in view of the inconclusiveness of the findings . . . there is no need to labor these conversations" and it amounts to "an unwarranted attempt to discredit a member of CAB."

• **Antitrust exemption** of ATA's articles of association should be withdrawn.

Republican Protest

The Republican minority argued that this exemption "in no way shields ATA or its member carriers from the antitrust laws" and that its withdrawal would accomplish nothing that cannot now be accomplished through antitrust enforcement. Similar exemptions have been granted by CAB to Conference of Local Airlines, Alaska Air Transport Assn., Caribbean Air Transport Assn., etc.

Legislation to change the policy of the 1938 CAA Act from "competition to the extent necessary" to "competition to the maximum extent practicable" was unanimously supported by the subcommittee. Any sweeping change in civil aviation law was ruled out: "In view of the prodigious growth that has been experienced . . . accompanied by comparable technological improvements with resultant values to the national defense . . . a major revision of the regulatory legislation is unwarranted and would be unwise."

More Competition

Other points made by the subcommittee were:

• **CAB should actively encourage** small carriers and "new and additional competition on the Big Four's routes . . . should continue to be a major objective. . . ."

• **CAB was urged to take** "expeditious action" to determine the "comparability" of airmail and air freight rates. "Inasmuch as the priority accorded air mail appears to exist in theory only, continuation of the disparity is difficult to justify." CAB also was called on "to take effective action to prevent air carriers from charging first class fares for flights in coach equipment".

• **"Uncontrolled industry** price fixing" under International Air Transport Assn. should be ended. Legislation should be enacted giving CAB the same power over "fares, rates, rules and practices" of international air carriers that it now has over domestic carriers. CAB, the subcommittee said, should also be given greater authority over foreign air carriers operating into the U. S.

• **Subcommittee majority** called for "a general investigation into all of Pan American World Airways' activities." But Republican members said that, in view of CAB investigations of the airline now already under way, this proposal is "without merit."

TWA Will Expand Kansas City Base

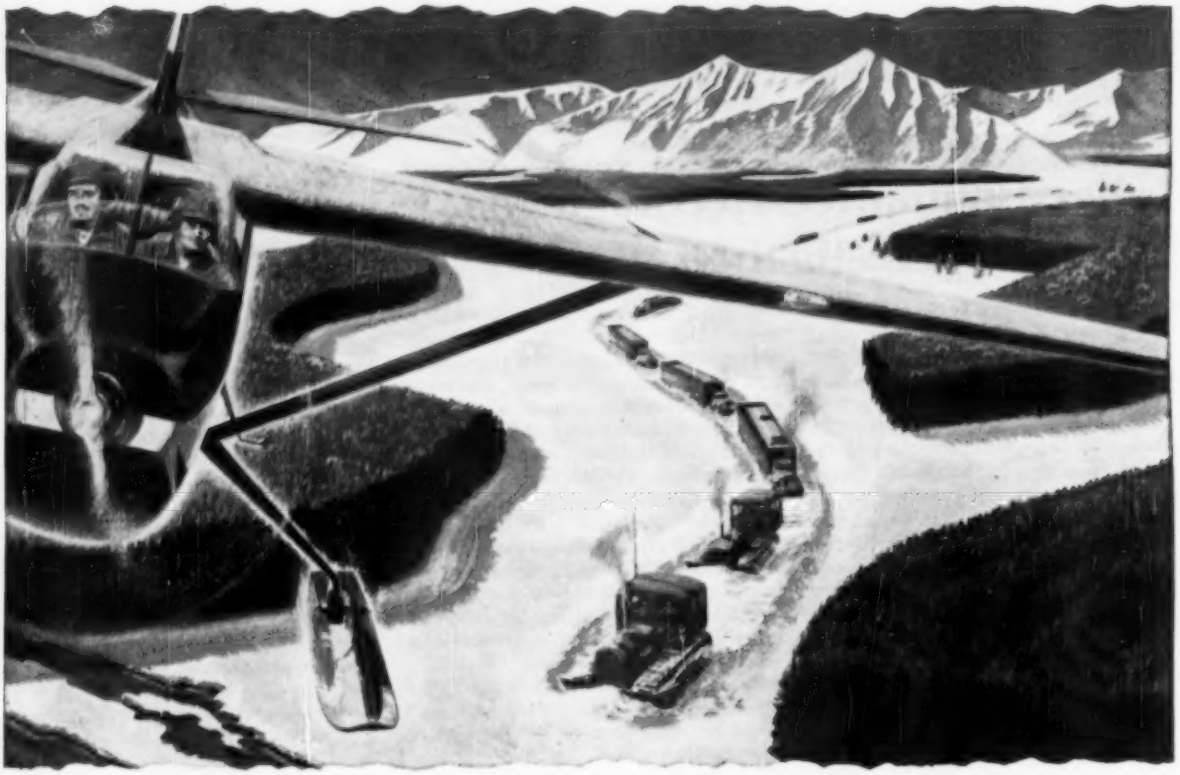
Kansas City—Trans World Airlines announced last week it will augment its $25 million overhaul base expansion program with a $12 million jet engine overhaul building at Midcontinent International Airport here.

George Clay, vice president of administrative services for TWA, said the building had been authorized by the board of directors and that construction will begin immediately. The new facility will be ready by the fall of 1958. Burns and McDonnell Engineering Co. of Kansas City is working on the building plans, and the construction firm of Sverdrup and Parcel is working on the plans for the test cells.

The building will be the same size as the piston-engine overhaul building also located here, 350 by 390 ft. Between 450 and 500 people will be employed in the new facility.

PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA



Breaking trail by air for Alaska "train"

Flying above the far north's trackless snow, Hawley Evans led this overland "train" carrying radar defense equipment to the shores of the Arctic Ocean. Giving directions by radio, he scouted safe passage over mountains, across steep gorges, between icy lakes in temperatures down to 68 degrees below zero.

"In that kind of weather," says Mr. Evans, "you really want to be sure of your plane. I play it safe as I can, with Chevron Aviation Gasoline. I've found that Chevron gives me more power on take-offs than any other that I've tried, and comes through with all the extra power I call for when I'm in flight. Even in bitter cold it keeps my engine running sweet.

"Another thing that helps make my flying safer, I'm sure, is RPM Aviation Oil. When we overhaul customers' engines in our shops at Fairbanks, we can tell the ones that have been on 'RPM'—they're always in good shape. It gives us many extra flying hours; keeps rings and valves free for the life of the engine. Even when it's pre-heated to the boiling point, it never breaks down."

TIP OF THE MONTH

Mr. Evans suggests that planes used in snow country be painted a bright color on top. Silvery surfaces often become invisible against the brilliant white background.

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AVIATION OILS RPM

T.M.'S "RPM," "CHEVRON," "PLANE FAX," REG. U. S. PAT. OFF.

Traffic Rules Cited as Helicopter Barrier

By L. L. Doty

Washington—Helicopter Council of the Aircraft Industries Assn. says present air traffic control procedures are retarding the development of commercial and air carrier helicopter operations.

In a paper submitted to the Aviation Facilities Planning Group, the AIA called for new Civil Air Regulations for helicopter flights that would be completely divorced from traffic rules governing fixed-wing operations. The council warned that an estimated 29 million helicopter operations exclusive of military flights can be expected by 1965 and added:

"Today's system is incapable of absorbing future rotary-wing demand."

Helicopter Needs

Here are the specific requirements based on the present state-of-art for helicopter operations urged by the AIA:

- **Special Civil Air Regulations** written to meet the unique performance characteristics of the helicopter and to fit future demands.
- **Low-altitude airspace and airways** for the exclusive use of helicopters.
- **Self-contained navigation system** based upon hyperbolic engineering concepts.
- **IFR facilities that will sustain** safe heliport operations under varying flight conditions without any loss in acceptance rate.

The report pointed out that the existing CAR prescribing air traffic procedures are based on fixed-wing requirements and are not adaptable to helicopter operations. It added:

"Since the flight characteristics of rotary-wing aircraft are at sharp variance with those of the conventional airplane, and since the airport and heliport have little in common . . . the helicopter has been operated under a series of prejudicial restraints, unable to take advantage of its inherent, superior flight characteristics."

The report charged that data and specifications for precision, all-weather navigational aids cannot be acquired under the present CAR. It accused "federal authority" of procrastination and said the prevailing "exemption type" CAR causes confusion and hesitation among municipal and state officials in approving heliports for helicopters operated by large business and industry.

In connection with air carrier operations, the report said the council was unable to assess accurately the expected degree of downward trend in helicopter operating costs because of present flight regulations. It added that helicopters are being forced to follow costly circuitous routes in accordance with visual flight rules applicable to fixed-wing aircraft, making it impossible to arrive at realistic operating costs that can be expected under a more efficient air traffic system.

The council claimed that the economics of helicopter operations have been subjected to "widespread misinterpretation" and added: "It is a fallacy to conclude that future reductions will reflect but minor downward trends."

Own Airspace

The report concluded that helicopters must operate in their own airspace from which fixed-wing aircraft are excluded. It said virtually all helicopter operations will be conducted between altitudes of 500 ft. and 2,000 ft., the optimum altitude for helicopters without compromising safety. It emphasized that safety and economic factors will preclude standard aircraft from invading this airspace.

The lower altitude operation, however, will prevent the use of vertical separation of aircraft in opposite-direction flight, the report said. Altitude layers, it added, cannot be used and control will be conducted on parallel flight tracks. The report emphasized that such a procedure should "no longer be resisted" and that the "mixture of fixed-wing aircraft and rotary-wing aircraft must be avoided at all costs in en route operations and especially within terminal areas."

The report termed precise terminal navigation a "mandatory requirement." In terminal area operations, the council called for a 500 ft. lateral separation on each side of a flight track when operating in multiple flight paths. In addition, the council wants a 500 ft. buffer zone coupled with a 250 ft. separation from the nearest obstruction. This would place distance between flight paths at 500 ft.

Because approach angles will range between six and 45 degrees, the council said "terminal approach aids must be developed with capabilities equal to providing accurate position data throughout the entire range of possible angles as well as in all permissible directions." It added:

"For this reason, the existing approach system of fixed-wing operations cannot be legitimately considered for modification. No realistic regulation can prescribe (for helicopters) the long, inflexible procedure established for fixed-wing aircraft."

The council admitted that initially air traffic control of high-density helicopter operations may resemble existing air traffic control procedures but warned that this system is deficient in terms of time consumed for clearance, assignment of altitude and maintenance of VFR acceptance rates under IFR conditions.

In this connection, the report called for an electronic monitoring device, probably similar to the Doppler on the Bendix Decca systems. It suggested that, meanwhile, radar is probably the best device to provide a lowering of the airport acceptance rate of helicopters.

The council admitted to technical difficulties resulting from the use of VHF equipment in low altitudes because of the problem in maintaining the necessary line-of-sight. And it noted that atmospheric disturbances and precipitation clutter reduced the value of low frequency in using an electronic monitoring device. For communica-

Flying Tiger DC-6A Repaired

Flying Tiger DC-6A, damaged in a forced landing on a Jamaica Bay mud flat shortly after takeoff from New York International Airport at Idlewild, taxies from a hangar at Lockheed Aircraft Service-International maintenance and repair base. Salvage and repairs, including replacement of four engines, most of belly skin and main gear, took about two months.

MAKES ANY PLANE A TANKER

Aeroproducts Ram Air Drive powers new "Buddy Store" — first successful tanker kit

Driven by an Aeroproducts full-feathering four-bladed turbine, this self-contained power unit provides all the power needed for pumps and reels. Remote-controlled from inside the cockpit, the entire "Buddy Store" unit can be jettisoned in flight, restoring full combat performance to the tanker plane.

For detailed information on how Aeroproducts can assist you with your aircraft accessory designs, write on your company letterhead for 28-page brochure, "Actuators for Aircraft" and new design catalog, "Aeroproducts Ram Air Accessories."

IT CONVERTS a fighter or attack bomber into a high-speed aerial tanker in a moment's notice. Quickly secured to rocket or bomb racks, the new lightweight "Buddy Store" makes any plane a tanker—without reducing its combat capabilities.

This first successful ram-air-powered tanker kit is lighter in weight, more streamlined in shape and requires no plumbing or power take-off from the tanker plane. The "Buddy Store" is completely self-contained and self-powered. A single cockpit control actuates the unfeathering solenoid. From here on an integral Aeroproducts Ram Air Drive Turbine supplies all the power required.

Already selected for the Douglas AD Skyraider and Douglas A4D Skyhawk, the "Buddy Store" further extends the combat range of the new Air Navy's carrier aircraft.

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tions by VHF, the council suggested the use of ground relay stations but emphasized that "efforts to overcome these problems must be continuously expedited pending further progress in the field of electronics."

The council said the potential of the helicopter will be substantially assured if a self-contained airborne navigational system capable of precision performance without reference to ground stations were to be perfected. It added that the most efficient navigational system for en route helicopter operations should be based on the "concept of area flexibility" to permit circuitous and multiple routings in congested areas.

Sales Pattern

The council predicted that the military services will no longer dominate as the leading purchaser of helicopters by 1965. In 1956, the Department of Defense accounted for 80% of helicopter sales, but the council expects it to account for only 40% in 1965.

The report said annual helicopter sales during the period 1957-1965 will average about 1,200 units per year as compared with approximately 550 units per year during the 1946-1956 period. It added that 70% of unit sales during the next nine years will occur 1961-65.

Largest users of non-military helicopters by 1965 are expected to be large business corporations, according to the council. By that date, 2,800 corporation helicopters, generating a minimum of 8.7 million trips annually, are expected to be in operation. Corporation helicopters will carry between two and 10 passengers at speeds of 80-115 mph. They will be powered by multiple turbine engines.

Commercial use of helicopters in such activities as aerial photography, crop spraying, surveys, forest patrol, evacuation, etc. is expected to create a market that will result in 2,300 helicopters in this field by 1965. The commercial fleet will generate a minimum of 1.8 million trips annually, according to the forecast.

Commercial helicopters will be operated at speeds of 65-90 mph. with payloads ranging from 1,500 to 3,500 lb. The council also expects single reciprocating engines will still power helicopters in this category.

Purchase of helicopters by the airlines is expected to account for only 8% of the market in 1965. By 1961, transport helicopters will be powered by multiturbine engines and will travel at speeds up to 160 mph. with 25-50 passengers.

A total of 800 transport helicopters will be operating by 1965 compared to 50 in 1956, the report said. The council added that "assuming expedited progress in the development of self-contained air navigation aids, the estimated 800 air carrier transport helicopters will, by 1965, generate approximately 4.8 million trips annually."

BEA Traffic Rises But Profit Slumps

London—British European Airways reports a drop of 64% in net profit last year despite a 14% upswing in total traffic.

BEA attributes reduction in net profit in part to higher costs. The airline also had "lowest level" of traffic revenue rate in company history.

Profit before charging interest on capital was $2,345,293 in 1956-57, against $3,364,394 for 1955-56, a drop of 30.9%. Capital expenditure during the year increased to $27,213,200 from $6,274,800 the previous year.

Total traffic increased to 89,685,423 ton-miles, but the company had anticipated an even bigger jump—20%—in 1956-57.

BEA says two factors explain why traffic fell short of expectations: the credit squeeze and trouble in the Middle East.

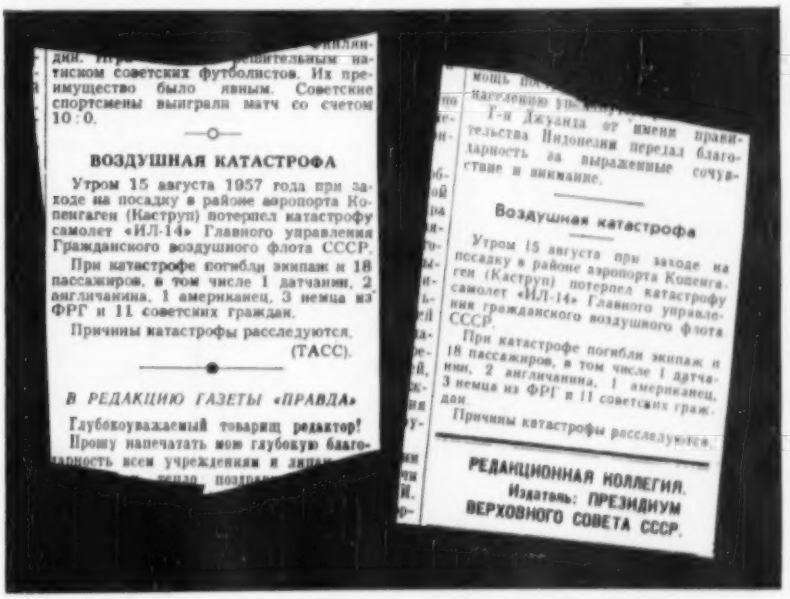
BEA's gross revenue was $67,053,767, compared with $60,478,583 the previous year and $11,551,490 in 1947-48, the company's first full year of operation.

Other statistics: revenue load factor 64.5%, up 2.1%; revenue passenger-miles 808,872,028, up 14.1%; available seat-miles 1,150,792,379, up 12.7%; passenger load factor 70.3%, up 1.3%.

New Bar Floodlights Slated for Idlewild

Washington—Civil Aeronautics Administration will begin installation of new fluorescent bar floodlights on the instrument runway at Washington National Airport on Nov. 1 and start evaluation tests shortly thereafter. The lighting fixtures and lamps are being provided under a $43,602 contract with Sylvania Electric Products Inc.

The new floodlights will be located on the south end of the instrument runway starting 200 ft. from the threshold and extending 1,300 ft. north. They will be installed on both sides of the runway.



...тисном советских футболистов. Их преимущество было явным. Советские спортсмены выиграли матч со счетом 10 : 0.

ВОЗДУШНАЯ КАТАСТРОФА

Утром 15 августа 1957 года при заходе на посадку в районе аэропорта Копенгаген (Каструп) потерпел катастрофу самолет «ИЛ-14» Главного управления Гражданского воздушного флота СССР.

При катастрофе погибли экипаж и 18 пассажиров, в том числе 1 датчанин, 2 англичанина, 1 американец, 3 немца из ФРГ и 11 советских граждан.

Причины катастрофы расследуются.

(ТАСС).

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...Т-н Джуанда от имени правительства Индонезии передал благодарность за выраженные сочувствие и внимание.

Воздушная катастрофа

Утром 15 августа при заходе на посадку в районе аэропорта Копенгаген (Каструп) потерпел катастрофу самолет «ИЛ-14» Главного управления гражданского воздушного флота СССР.

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РЕДАКЦИОННАЯ КОЛЛЕГИЯ.

Издатель: ПРЕЗИДИУМ ВЕРХОВНОГО СОВЕТА СССР.

Aeroflot Crash Buried in Pravda

Moscow—Soviet press, faced with the new problem of reporting Aeroflot crashes on foreign soil, apparently has adopted a policy of minimum publicity.

The crash of an Il-14 transport into Copenhagen harbor on Aug. 15 which killed all 23 persons aboard rated identical 12-line items in Moscow's principal dailies, "Pravda" and "Izvestia." Both items were printed in small type and buried at the bottom of the last column of the last page.

The newspapers' account was captioned "Air Crash."

It read as follows:

"On the morning of August 15, a USSR Aeroflot Il-14 crashed while preparing to land at Copenhagen's Kastrup Airport. The crew and 18 passengers, including one Dane, two Britons, one American, three East Germans and 11 Soviet citizens, were killed in the catastrophe. Cause of the crash is being investigated."

Aeroflot's domestic crashes still are not mentioned in the Soviet press unless the accident involves foreigners or is known to foreign reporters

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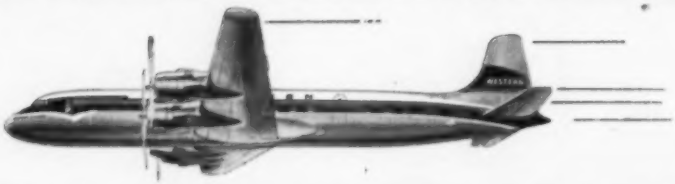

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Now you can enjoy the incomparable luxury of Western's world-famed "Champagne Flights" *all* the way to Mexico City! Reserved seats, gourmet dining, vintage champagne and orchids for the ladies—at no extra fare—will make your flight to this friendly and fascinating country seem all too short. No longer do you have to change airlines. Now you can enjoy America's smartest air service *all* the way to Mexico City on Western Airlines!

SHORTLINES

▶ **American Airlines** will begin new luxury service in Douglas DC-7s between New York and Chicago on Sept. 8. The new flights, two round trips daily, will be scheduled to leave both New York and Chicago at 4 p.m. and 5 p.m. with a $3 surcharge for the flight. On Sept. 3, American will begin Douglas DC-6 commuter flights between New York and Boston with three non-stop flights daily in each direction. On Sept. 15, the schedule will be extended to include Washington. The DC-6 flights will replace or supplement Convairs on the routes.

▶ **Allegheny Airlines** will resume scheduled operations to Jamestown, N. Y. on Wednesday. The Jamestown Airport has been closed since May for repairs.

▶ **Pan American World Airways** has opened a telephone tie-line between Miami and Havana to speed continuing reservations confirmation. Using the former radio method from Havana, the airline had to radio reservations control in Miami where continuing reservations were made and a second radio message sent back to Havana. With the new telephone tie-line, an agent makes the confirmation himself.

▶ **Air Cargo Inc.**, whose stock is held by 28 airlines, reports that air freight carriage by the scheduled airlines has increased in the past decade by more than 1,000%. Most of the increase was attributed to a nation-wide agreement between Air Cargo and ground-haul services whereby the latter delivers to and from airports. Since 1947, the number of air freight shipments handled has grown from 105,018 per year to 1.2 million in 1956.

▶ **Braniff Airways** has declared a dividend of 15 cents per share payable to shareholders of record as of Sept. 6. The airline reports that increasing sales in 1957 have closed the gap between sales and added capacity on domestic routes. On international routes, Braniff said sales have exceeded added capacity. The result of these developments has been an increase in net income. For the period ending July 31, net income was 1.2% better than last year's despite a $1,249,000 increase in depreciation charges. Non-operating expense for the period increased 112%, leaving net income for the first six months of 1957 slightly behind the same period last year. This was due mostly to additional interest charges. Braniff completed in 1956 the full financing necessary in connection with its new aircraft program.

AIRLINE OBSERVER

▶ Aeronaves de Mexico will encounter no delay in introducing the turboprop Britannia on its Mexico City-New York route approved last week by President Eisenhower as will Northeast Airlines. Northeast has been impeded by Civil Aeronautics Board's refusal to grant it a waiver on landing gear "pivoting" requirements (AW July 1, p. 45). Board ruling that Northeast must comply with type certificate provisions calling for the pivoting characteristic before the Britannia is placed into scheduled service is delaying the introduction of the turboprop transports on Northeast's routes. However, the ruling will have no effect on Aeronaves operations of the Britannia which it hopes to receive this fall. The Board has held it will accept type certification of aircraft operated by foreign flag carriers into the U. S. when approved by the airline's government.

▶ **Ghana has received proposals from KLM Royal Dutch Airlines to establish a Ghana airline operated jointly by Ghana government and KLM. According to sources in Accra, proposals call for direct service between Ghana, United Kingdom and other European countries. KLM has offered to train ground and air crews of Ghana nationality. The new nation's Ministry of Communications is said to be inviting KLM officials to discuss the proposals.**

▶ Curtiss-Wright president Roy Hurley and a party of company engineers have been in France talking to Sud Aviation regarding the use of the Wright TJ38 turbojet engine as a powerplant for the Caravelle jet transport.

▶ **President Eisenhower has approved renewal of KLM's foreign air carrier permit to operate between New York and Amsterdam and between the Netherlands Antilles and Florida. The President also approved KLM's new routes to Houston and from the Antilles to New York.**

▶ American Airlines July cargo outbound from Mexico was greater than inbound cargo for the first time since the airline began cargo service in Mexico in 1944. During the month, American moved 379,000 lb. of cargo out of Mexico compared to an inbound figure of 318,630 lb. The surprising turn spotlights the growth of Latin America cargo business.

▶ **Poland is making good progress on construction of its 20 passenger MD-12 transport (AW June 17, p. 77), according to Russian sources. Equipped with four, 350 hp. engines, the MD-12 will have a speed range of 106-180 mph. It will be able to use shorter runways than current Polish transports.**

▶ Miami's International Airport is forecasting a passenger total in excess of 5 million for 1957. During the first half of the year, 2.2 million passengers went through the airport, an increase of 11% over the same period last year. The 1956 passenger total was 3.5 million.

▶ **Trans World Airlines, never missing an opportunity to plug its international service, has printed stickers reading "via TWA" to be placed by airline personnel on fences and buildings in Europe where the phrase "Yank go home" has been scribbled.**

▶ Willis Player, former public relations vice president of the Air Transport Assn., has been elected vice president of American Airlines and will assume his new duties next month, working with Rex Smith, vice-president-public relations.

▶ **Watch for the transfer of some short-haul routes by the Canadian government from Canadian Pacific Airlines and Trans-Canada Airlines to smaller airline operators. CPA is known to be planning the abandonment of some of its domestic routes in favor of developing its overseas services. Recently, Trans-Air, Ltd. was granted two routes operated by CPA from Winnipeg to the northern Manitoba mining region and from Winnipeg to Churchill on Hudson Bay, a joint Canadian-U. S. defense and rocket-firing base.**

▶ Japan Air Lines will increase its weekly flights between San Francisco and the Orient from five to seven next spring, according to Yoshito Kojima, vice president of the airline for the American region. The increased schedule will be made possible by the addition of four DC-7Cs to JAL's fleet.

The new pride of Eastern...
PROTECTED BY SINCLAIR

Latest Eastern Air Lines plane to bear the illustrious Golden Falcon name is the Super G Constellation. This new titan of the skies carries 70 passengers – has an increased cruising range and includes 107 new design features. It embodies new luxury, style and comfort – retains its traditional dolphin-like grace and triple tail.

Its four great Turbo Compound engines that generate 13 thousand horsepower are protected with Sinclair Aircraft Oil. Eastern uses Sinclair Aircraft Oil *exclusively* because of its proved quality and dependability over the years. In fact, today 45% of the aircraft oil used by major scheduled airlines in the U.S. is supplied by Sinclair. There's no better proof of reliability.

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SUPER-G

Helicopters

By Robert Farrell

Paris—Heavy helicopters are significantly faster and cheaper than conventional ground methods in oil drilling cargo operations and exploratory work in the New Guinea jungles.

Taking over the entire job of shuttling men and heavy drilling equipment between scattered jungle sites, three Sikorsky S-58s flying in New Guinea have done in a few months what normally would have taken 18. By relying on helicopters, oil companies have been spared the trouble of hacking costly roads through dense jungle. Oil concerns have discovered they can step up their exploratory programs in jungle areas to a rate never before thought possible.

The New Guinea operation, launched last March in Papua, clearly demonstrates the potential of helicopters in areas extremely costly or impossible to reach by ground transportation.

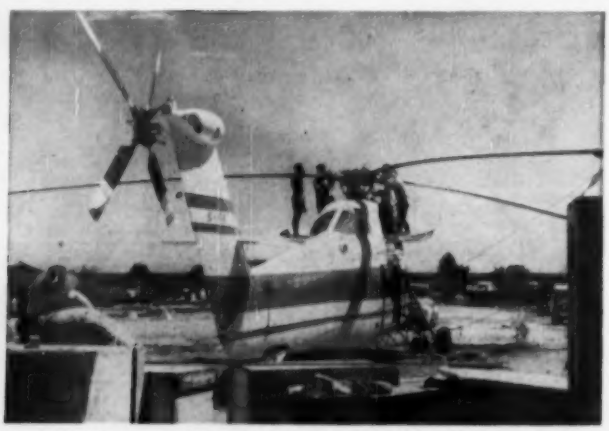
WEIGHTS are marked on loads for quick reference. S-58 approaches camp to pick up load.

NATIVE standing by mud tank protects ears from noise as S-58 leaves for drill site.

Inaccessible Terrain

Perhaps what is more significant, helicopters are permitting companies to probe promising oil areas located in jungle terrain accessible only to rotary-wing aircraft. Already carrying such names as "rig-a-back" and "helirig," the S-58 New Guinea operation looks like it might prove to be a major breakthrough in one of the oil industry's toughest problems: how to get its heavy drilling equipment in and out of inaccessible areas.

Credit for doing the spade work in adapting helicopters for oil hunting tasks in jungle areas generally goes to World Wide Helicopters Ltd., formerly Bahamas Helicopters Ltd. As the old



PIECED steel matting is hooked onto hovering S-58 (left). Ground crew (right) assembles S-58 at Port Moresby after sea trip from U. S. Helicopters were sprayed with plastic for protection at sea and first two S-58s delivered went through typhoon without damage.

Overcome Terrain in Jungle Oil Search

name suggests, the outfit is a Bahamian corporation though headquarters are in Paris. Most of the top posts are held by Americans although 90% of the employes are of varying nationalities.

World Wide has been working on contracts with oil concerns since 1952, both in the South Pacific and elsewhere. Much of its work is more or less similar to that being done in the U. S. by commercial helicopter outfits working for oil companies, (AW Dec. 31, 1956, p. 27), but recently World Wide has developed with the oil companies its entirely new type of operation.

In addition to the now familiar role of transporting seismic and other survey parties, work gangs, equipment and supplies—for which Bell 47Ds and Westland-Sikorsky S-55s are used—World Wide's three S-58s are hauling into the jungle all the equipment and personnel needed for an entire drilling operation. This means S-58s are carrying drill rig sections, disassembled bulldozers, as well as a variety of other heavy oil drilling equipment never before lifted by helicopters. To do the job, World Wide, together with its oil company customers, have worked out special cargo handling and flying techniques which are designed to utilize the S-58 as much as possible as a flying crane.

World Wide clinched its argument on the use of helicopters for hauling drilling equipment after an earlier, so-called "successful failure" operation. The company, under an experimental contract with Royal Dutch Shell, undertook to carry out what turned out to be the first air-lifting of an entire drilling operation.

Drilling Site

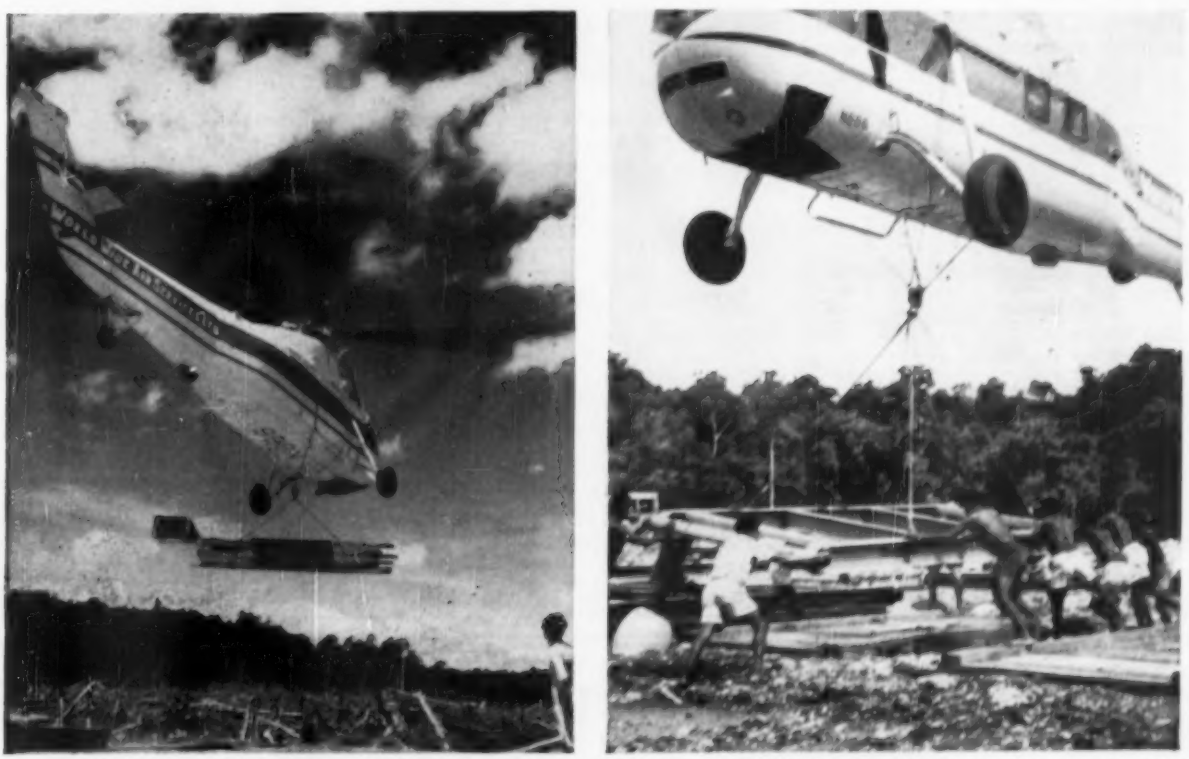
Westland S-55s were used on this job, which took place at Sorong, Netherlands New Guinea. The drilling site was located in dense jungle, about 16 miles from the coastal supply base. Shell estimated it would take 12 months to build a road through bottomless swamplands and another three to drag in the drilling equipment. Two S-55s did the job in six weeks.

Since the well eventually was abandoned as "dry," Shell understandably was relieved it hadn't invested huge sums building a road into the site and spent 15 costly months on a wild-goose chase. Hence the term "successful failure."

The Sorong venture also demonstrated that the S-55, with its 1,500 lb. maximum payload, was too light to be used as standard equipment. Having thus created a demand among the oil companies for heavier rotary-wing aircraft, World Wide last fall made its first public stock offering to finance the purchase of the three Sikorsky S-58s and parts costing in excess of $1 million.

With its 4,000 lb. payload, the S-58 appears to fill the mission requirement. This consists of lifting sections of a National 50 oil drilling rig which just fit under the S-58 maximum payload. A National 50 rig permits drilling down to 10,000 ft. This covers the majority of oil strikes. The next size oil rig, the National 100, at its present weight could only be air-lifted in sections by a helicopter with a payload at least four times that of the S-58.

Ami L. Sumarlidason, World Wide executive vice-president, feels that oil



LEAVING river camp (left), S-58 starts for drilling site to deliver a load of lumber. Skid for drilling rig engines is swung into correct position for mounting by ground personnel (right). Helicopters can place some equipment in proper place for assembly.

COLE SWITCHES
are being used on the new
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(Illustration courtesy of Lockheed Aircraft Corp.)

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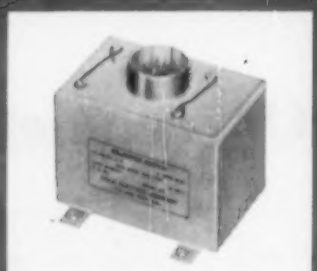
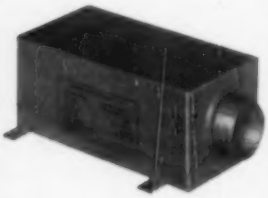
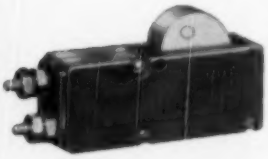
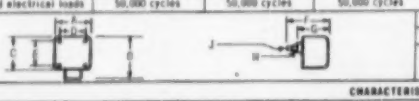






COLE SWITCHES NOW BEING MANUFACTURED

Characteristic	B2376	B2375	B2851	C-372	C-354	C-324	C-848
Description	Switch-landing Gear sequencing & indicating Rotary actuated Hermetically-sealed	Switch-landing Gear sequencing & indicating Rotary actuated Hermetically-sealed	Switch-landing Gear sequencing & indicating Rotary actuated Hermetically-sealed	Switch-Horizontal Stabilizer control	Switch-Limit Oil filled	Switch-Limit Dust tight	Switch-Rocket Squib
Contact arrangement	S.P.D.T. 2 Circuit	D.P.D.T. 4 Circuit	4 P.D.T. 8 Circuit	S.P.D.T. 2 Circuit	S.P.S.T. normally open	S.P.S.T. normally open	S.P.S.T. normally closed
Pretravel (Max.)	180°	180°	180°	25°	3/64	7/64	0.7
Overtravel (Max.)	180°	180°	180°	10°	3/8	1/4	3/16
Movement differential (Max.)	7°	7°	7°	25°	5/64	.020	Not applicable
Temperature range	−65°F to +250°F	−65°F to +250°F	−65°F to +250°F	−65°F to +185°F	−65°F to +185°F	−65°F to +185°F	−65°F to +185°F
Electrical rating @ 30 V.D.C. Sea level (Amperes)	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 250.0 Ind. 50.0 Motor 50.0	Res. 15.0 Ind. 7.5 Motor 7.5	Res. 15.0 Ind. 7.5 Motor 7.5	Res. 2.0 Ind. 1.5 Motor 1.5
50,000 feet (Amperes)	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 125.0 Ind. 25.0 Motor 25.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 10.0 Ind. 5.0 Motor 5.0	Res. 2.5 Ind. 0.75 Motor 0.75
Vibration	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743
Shock	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743	MIL-S-6743
Life @ rated electrical loads	50,000 cycles	50,000 cycles	50,000 cycles	25,000 cycles	50,000 cycles	50,000 cycles	50,000 cycles



Dimensions

Switch Type	A	B	C	D	E	F	G	H	J
B2376	1.75	2.25	1.63	1.38	1.25	1.87	1.45	5/16-36 SAE Serration	10-32 NF-2A Thread
B2375	1.75	2.25	1.62	1.38	1.25	2.39	1.95		
B2851	1.75	2.25	1.62	1.38	1.25	2.39	1.95		

CHARACTERISTICS

Characteristic	Switch Type B2376	Switch Type B2375	Switch Type B2851
Contact arrangement	S.P.D.T., 2 Circuit	D.P.D.T., 4 Circuit	4 P.D.T., 8 Circuit
Contact separation	.047 (Nom.) (Double)	.047 (Nom.) (Double)	.047 (Nom.) (Double)
Free travel (either side of actuating point)	180° (Min.)	180° (Min.)	180° (Min.)
Movement differential	7° (Max.)	7° (Max.)	7° (Max.)
Operating force	2.5 in. lbs. (Max.)	2.5 in. lbs. (Max.)	2.5 in. lbs. (Max.)
Contact pressure	100 gms. (Min.)	100 gms. (Min.)	100 gms. (Min.)
Temperature range	−65°F to +250°F	−65°F to +250°F	−65°F to +250°F
Electrical rating @ 30 Volts D.C. Sea level or 50,000 feet	Resistive: 10 Amps. Inductive: 5 Amps. Motor: 5 Amps.	Resistive: 10 Amps. Inductive: 5 Amps. Motor: 5 Amps.	Resistive: 10 Amps. Inductive: 5 Amps. Motor: 5 Amps.

Characteristic	B2376	B2375	B2851
Life @ rated loads	50,000 cycles	50,000 cycles	50,000 cycles
Dielectric strength	1000 volts RMS	1000 volts RMS	1000 volts RMS
Contact resistance	.020 ohms (Max.)	.020 ohms (Max.)	.020 ohms (Max.)
Continuous current	MIL-S-6743	MIL-S-6743	MIL-S-6743
Overload	MIL-S-6743	MIL-S-6743	MIL-S-6743
Short circuit	MIL-S-6743	MIL-S-6743	MIL-S-6743
Vibration	MIL-E-5272A Proc. II	MIL-S-6743	
Shock	MIL-S-6743	MIL-S-6743	MIL-S-6743
Corrosion	MIL-E-5272A	MIL-E-5272A	MIL-E-5272A
Humidity	MIL-E-5272A	MIL-E-5272A	MIL-E-5272A
Leak rate	10-4 cu. ft./year	10-4 cu. ft./year	10-4 cu. ft./year

FEATURES: (1) **Hermetically-sealed.** (2) **Multiple circuit control.** (3) **High contact rating.** (4) **Precision snap action.** (5) **Simultaneous make or break regardless of actuator speed.** (6) **Small angular movement differential (4° to 7°).** (7) **360° rotation of actuator — no stops.** (8) **High reliability.**

(Keep this chart for engineering reference)

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equipment makers have paid little heed to weight but that in the future they will tend to design their equipment with an eye to its being airlifted by helicopter. At any rate, the S-58, or other helicopters in its payload category, won't be obsolete for oil drilling operations for some time to come.

First two S-58s went into service in Papua on March 8 of this year. The third joined the jungle operation on June 5. World Wide is using them under a contract signed with an oil group jointly controlled by British Petroleum Co. and Standard-Vacuum Oil Co.

It runs for 18 months, at which time it continues in force unless terminated on 90 days notice by either party.

World Wide is paid $50,000 monthly for the S-58 work. Sumarlidason estimates the company's profit margin on the contract at 20%, about average for World Wide, although on some contracts the profit margin has reached 25%. In general, the Papua operation works in the following manner:

Survey parties are first transported over the jungle region by Bell 47Ds. For this service the oil companies pay World Wide under a separate contract a monthly fee of $22,500. World Wide uses three Bells on the job, two flying with one held in reserve. On the basis of reports by the survey teams the oil firms then select sites for drilling.

In Papua these sites usually range from 15 to 25 miles from the nearest navigable river. On the river bank a large area is cleared and a camp established. Heavy supplies and equipment

Dutch Floats on Jet Copter

Small Kolibre ramjet-powered helicopter is shown undergoing suitability trials of its new multi-chamber rubber floats developed by the manufacturer, Netherlands Helicopter Industry N.V., Rotterdam, and produced by RFD-Holland, Ltd., Katwijk. Kolibre's two 60-chp. ramjets provide sufficient power to permit copter to lift twice its weight. Firm has orders for several agricultural versions of the copter fitted with 49-ft. spray booms. It has also developed a "Helicar" special trailer on which the Kolibre lands and takes off and uses for surface transport.

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F32-I-O	0- 32 inch ounces
F80-I-O	0- 80 inch ounces
F160-I-O	0-160 inch ounces

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are boated up the river to the base camp landing. In Papua there are about five of these river base camps.

Aerial liaison between river camps and Port Moresby, 200 to 600 miles distant, depending on the location of the river camp, is supplied by a World Wide owned and operated PBY Catalina which is rigged to carry 21 passengers in conventional configuration or 6,000 lb. of cargo, the latter usually being perishable food or critical cargo. At Port Moresby, World Wide maintains personnel living quarters, supply and storage depots and complete facilities for repair and maintenance work.

Base Facilities

In cooperation with the oil companies, World Wide sets up extensive repair and maintenance shops at each river base camp. Thanks in part to the huge amount of equipment lugged about by the oil drilling companies, World Wide can handle all S-58 maintenance work, including major overhauls, right in the jungle. Engines are sent out. Company mechanics are occasionally sent back to Port Moresby with components to repair, but this is done to get them out of the jungle, not because the same work couldn't be done at the river camp.

The company uses six pilots and 12 mechanics for the S-58 operation. Pilots fly alone and work on a rotation basis with three working and three resting in Port Moresby with their families.

At the river "helibase," a large shed is constructed to house all the material shipped in by boat. Near the shed another building is constructed, usually consisting of six open bays. Into these bays are moved by crane from the shed all the loads to be lifted by helicopter.

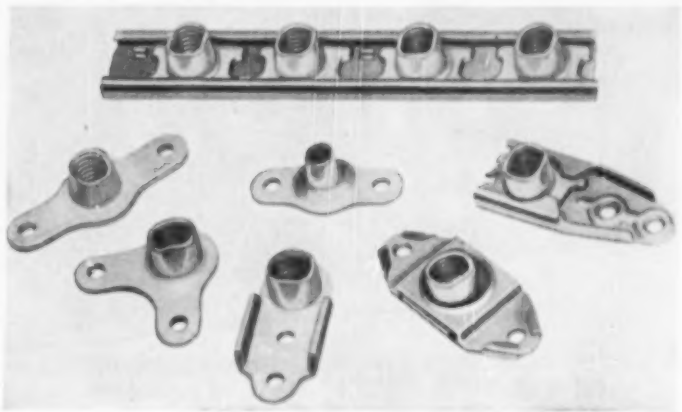
The loads are arranged into "packages" not exceeding the S-58's 4,000 lb. maximum payload. The weight of each load is clearly marked on the package in white paint, but as a final check a scale on the crane again weighs the load while moving it into the bay. Loads are stacked in the bays in the order in which they will be needed at the drill site.

Shuttle Service

Once the "rig-a-back" operation begins, the S-58 shuttles back and forth between the bays and the drilling site. Generally, the S-58 carries enough fuel to make from two to three trips before touching down. Once the drill site is sent up, the helicopter operation slows down. Supplies are maintained and drilling crews rotated by air as a fixed schedule. In the final phase, the pace quickens again as all the equipment is air-lifted out.

Before any flying between river camp and drilling site begins, native

FASTENER PROBLEM



New weight saving line of stainless steel locknuts for temperatures up to 800° F.

New aircraft designs contemplate speeds of Mach 2 and 3; missile designs push further ahead into the unexplored problems to be faced at speeds of Mach 5 and 6. Projected skin temperatures go higher and higher and in many cases pass the point where aluminum performs satisfactorily. As a result stainless steel will be specified for many of the new generations of fighters and missiles.

Fasteners, too, must be upgraded to meet the special requirements imposed by these projected speeds and higher temperatures. ESNA's solution is a new line of Type 305 stainless steel nuts designed to perform efficiently at temperatures up to 800° F; silver plated to assure a constant locking torque, freedom from galling action and a high degree of re-useability.

The new 70LH series is significantly lighter than the type of fasteners previously available for this kind of application . . . 16% lighter in some sizes . . . in others as much as 63%!

Configurations in the 70LH lines include the one and two lug, fixed and floating type anchor nuts; corner mounting type and gang channel nut strips, most of which are illustrated above. Thread sizes available in the anchor line for each configuration are 6-32, 8-32, 10-32 and ¼-28. These sizes with the exception of 6-32 also are available in the gang channel nuts.

Like all Elastic Stop nuts, those in the new LH series are self-locking, vibration-proof and high reuse is guaranteed.

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☐ Here is a drawing of our product. What self-locking fastener would you suggest?

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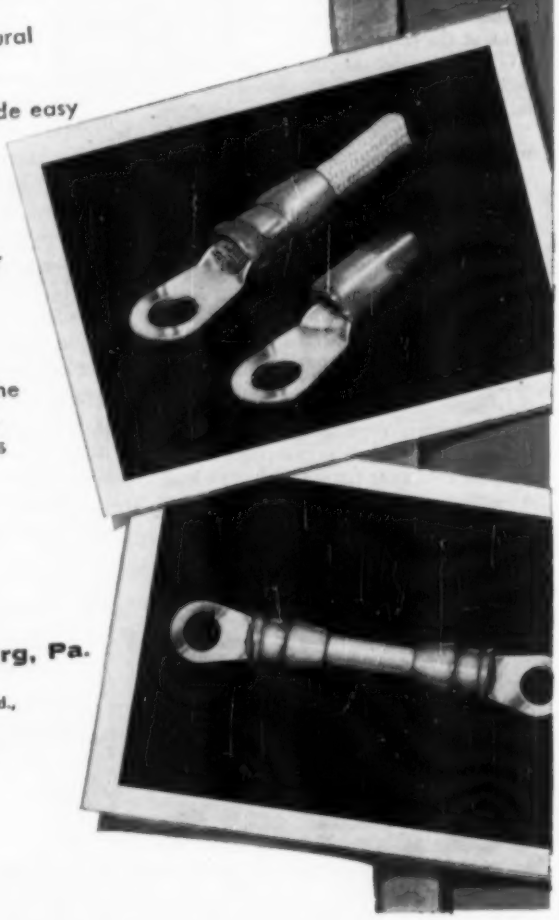
Additional information is available on request.



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crews are sent to the drilling site. They clear an area at the site just big enough for a S-58 to land. As a precautionary measure, emergency clearings between the river camp and the site are hacked out of the jungle at intervals of two miles. Thus a pilot is never more than a few minutes from a landing area.

First piece of equipment to be airlifted to the drilling site is a 25-ton D7 type Caterpillar bulldozer. The Caterpillar company has worked out a packaging arrangement on the D7 which enables it to be broken down and airlifted by a S-58 in 13 trips. Once on the site, the bulldozer is quickly assembled and clears the site for the rig and ancillary buildings. Meantime, the S-58 flies in the equipment and supplies as needed.

Oil companies have discovered that the S-58s fly in the equipment and supplies must faster than had been anticipated. In fact, the S-58s can move the cargo faster than it is needed. This permits a S-58 to work on more than one site at a time.

Supply Volume

Once a drilling site is in operation, supplies for two weeks are maintained. World Wide has found that two S-58s can set up a complete drilling operation, involving the movement of between 2½ to 3 million pounds of cargo, within 10 to 12 days. This is faster than needed, the usual time being paced at six weeks.

Since the S-58s in Papua have been in operation less than six months, it is somewhat risky to generalize on results. Some idea of the S-58s potential can be realized even so by what has been achieved to date. The average flight between river camp and drilling site has been 15 mi. Average payload in June, when all three S-58s were operating, worked out to 3,600 lb. On a busy day, World Wide officials say, one S-58 may carry 15 loads at an average payload of 3,960 lb. One pilot, flying 5 hr. and 40 min., hauled 98,000 lb. of cargo to a drilling site. More recently, a team of two S-58s carried 75,000 lb. in one morning to a drilling site located 12 mi. from the river camp.

The type of cargo hauled by the S-58s covers an impressive range of equipment and supplies. World Wide officials say 90% of these loads are slung externally. Cargo includes broken-down rig sections and bulldozers, lumber, fuel, cement, pipes and a variety of other equipment special to oil drilling operations. The heaviest piece of single equipment air-lifted probably is a mud tank, which weighs 3,950 lb., is 10 ft. deep, 10 ft. wide and 16 ft. long.

World Wide S-58 pilots have discovered that heavy but compact loads like a mud tank are not as difficult to sling and fly as loadings of pipe, which

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All LEWIS thermocouple indicators are fully cold-end compensated, magnetically shielded and are available for use with iron-constantan, copper-constantan or chromel-alumel thermocouples in all standard ranges for the thermocouple material used. A few typical ranges are listed below.

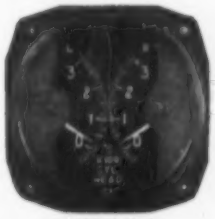
MODEL 17B

MODEL 17B, 2¾" case to AND 10401
—50 to +300°C Cylinder Temp. (AN 5536-1A or T1A)
—50 to +300°C Bearing Temp. . . .
0 to +1000°C Exhaust Temp.

MODEL 49B

MODEL 49B, 1⅞" case to AND 10403
—50 to +300°C Cylinder Temp. . . .
0 to +1000°C Exhaust Temp.

MODEL 76B dual, 2¼" case to AND 10401
—50 to +300°C Cylinder Temp. (AN 5536-2A or T2A)
—50 to 300°C Bearing Temp. . . .
0 to +1000°C Exhaust Temp.



MODEL 76B

RESISTANCE TYPE

Accurate ratiometers, these LEWIS indicators are remarkably free of voltage error, have nearly linear scales (not crowded at the ends) and are magnetically shielded. A few typical ranges are given below. Not shown is Model 46B, 2¾" single.

MODEL 47B

MODEL 47B, 1⅞" case to AND 10403
—70 to +150°C AN 5790-6 or AN 5790T6
0 to +125°C Oil Temp. . . .
—50 to +50°C Air Temp.

MODEL 77B

MODEL 77B dual, 2¼" case to AND 10403
—70 to +150°C AN 5795-6 or AN 5795T6
+30 to +230°F Oil Temp. . . .
+100 to +300°C Cylinder Temp.

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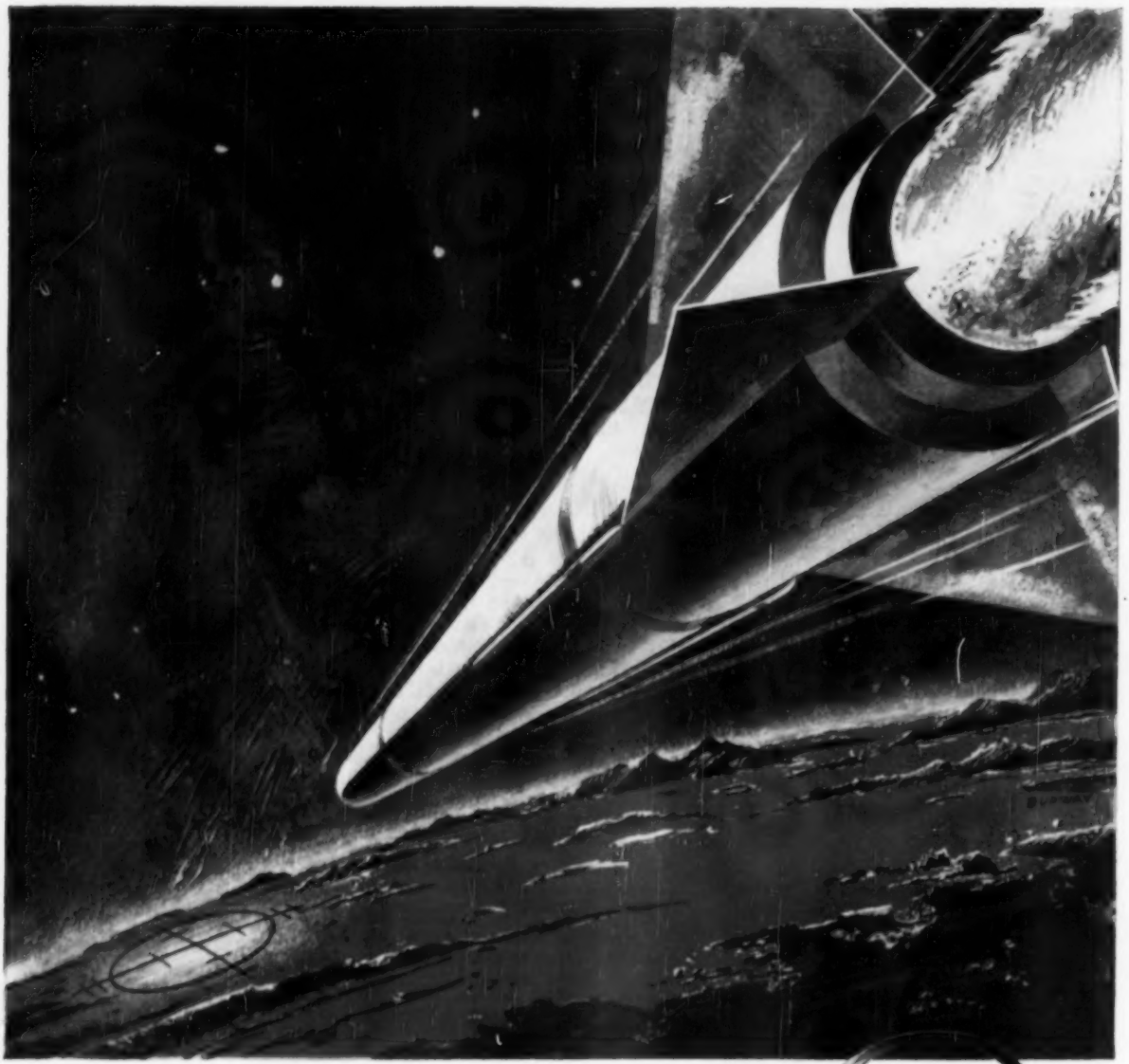

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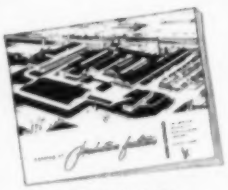

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run as long as 60 ft., or other lengthy loads like lumber and steel girders. Loads of this latter type have a tendency to rotate or oscillate while in flight. Pilots confess to an odd feeling upon seeing a load of piping much like the hand of a clock, slowly rotate, through their downward view from the cockpit.

Flight maneuvers have been worked out to correct such wayward movement of cargo. By flying a pattern which can best be described as a series of linked turns, pilots are able to keep the cargo more or less in line with the aircraft. World Wide pilots have gone further by developing approach maneuvers which result in turning the cargo, if need be, to fix it in the correct ground position. When flying in oil ring sections, S-58 pilots are often able to hover over the work area so that the new section can be joined to the rig and bolts fitted without any need for ground personnel to wrestle the section into place.

World Wide S-58 pilots believe they have encountered something new in rotary-wing flight phenomena, something which Robert Wilson, World Wide helicopter pilot and until recently operations manager of the Papua job, calls "air resonance." The phenomenon has been experienced by World Wide pilots on both the S-58 and the S-55 while carrying loads. Effect of the "air resonance" phenomenon, if it is not corrected, is to make control of the helicopter nearly impossible because of intense vibration and rolling. Wilson told AVIATION WEEK the problem has since been solved by the development of a flight pattern which tends to neutralize the phenomenon. World Wide pilots are often able to anticipate the phenomenon and correct immediately.

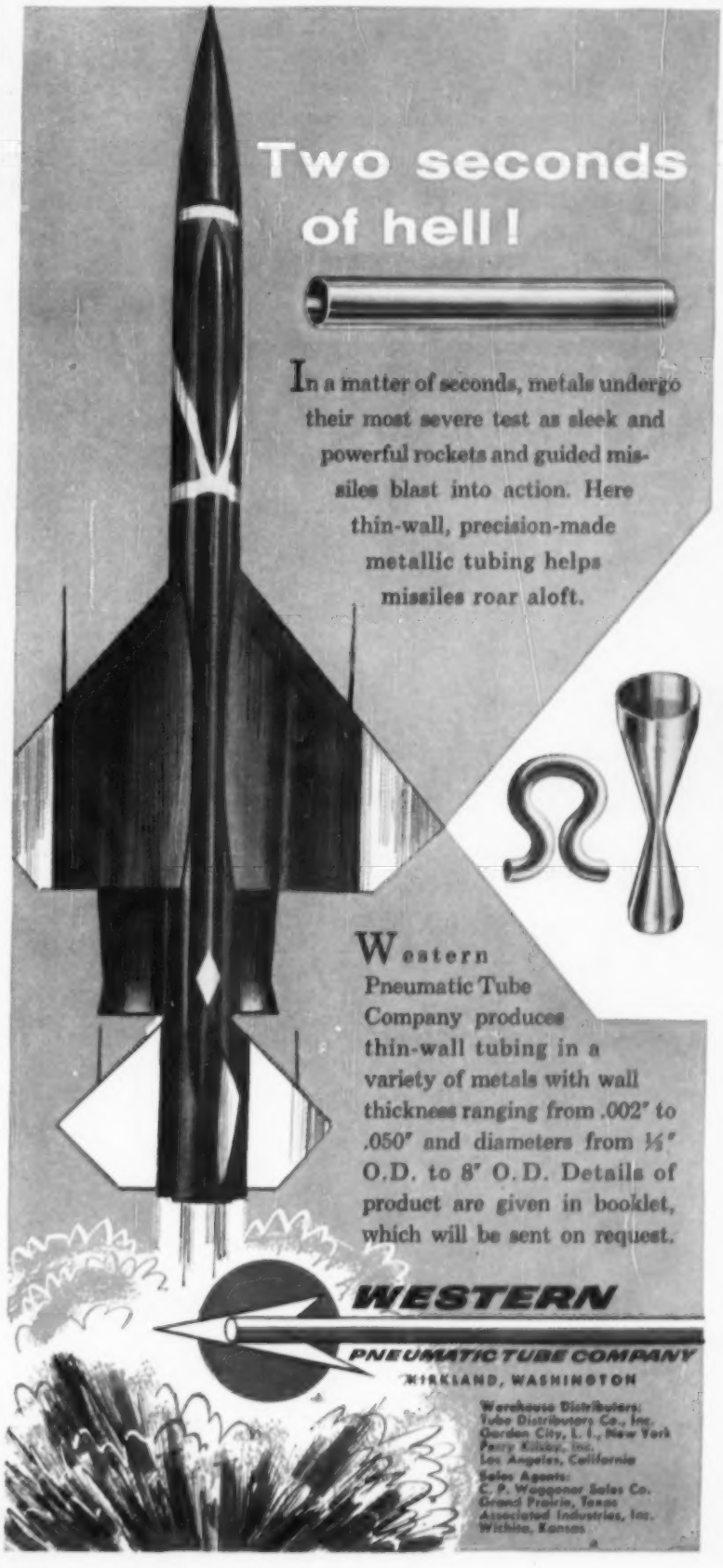
Load Jettisoned

Air resonance was the cause of World Wide's only incident where a load had to be dumped in order to avoid a possible accident. During the "successful failure" operation, Wilson was flying a Westland S-55 with a 39 ft. I beam slung underneath. The S-55 was at 1,500 ft. and making 50 kt. when it began to vibrate and oscillate. Wilson says the phenomenon starts as lateral vibration which intensifies until the aircraft is rolling by as much as 50 deg.

"You can't control it by conventional corrective procedures," Wilson says. "The aircraft shakes so badly you can't even read the instrument panel."

Unable to regain control, Wilson jettisoned the I beam into the jungle. Immediately the S-55 resumed normal flight characteristics.

Wilson says no one is exactly sure what brings on air resonance. It can occur at any altitude and at any speed. Pilots guess it is brought on by a com-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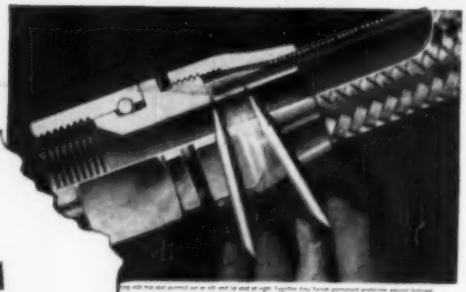

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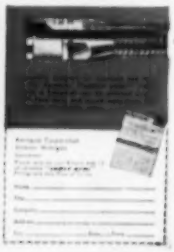

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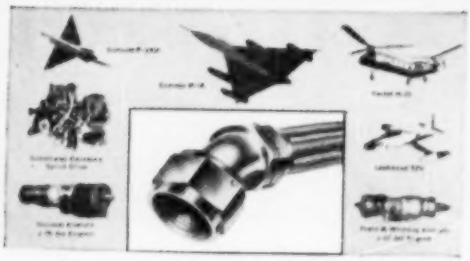

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Otter Fitted As Fire Fighter

A 90-gal. tank atop each float on this fire fighting DH-Canada Otter has been found more effective in beating forest blazes than pumps and water bombs, says operator, Air Service Division, Department of Lands and Forests, Ontario. Tanks are reloaded in 18 sec. by simply landing plane on water and dragging refill pipes (shown mounted on inner side of each float). Division uses 40 DHC-2 Beaver and five DHC-3 Otter aircraft in patrolling 400,000 sq. mi. of Ontario's Northland.

bination of the way the load is carried, forward airspeed and sling cable tension.

The best theory seems to be that sling loads of a certain type lower the aircraft's center of gravity to a point where stability is difficult to maintain. At any rate, Wilson says "air resonance" is no longer a problem for World Wide.

To correct the phenomenon, World Wide pilots change power settings to regain stability.

New Sling

The S-58s used in the Papua operation are the first to be equipped with a new prototype Sikorsky 5,000 lb. sling and hook which apparently satisfied both World Wide and the oil companies.

The load can be released three ways:

- **If the load** is touched down, easing off 150 lb., the hook releases automatically.
- **Pilot can release** it electrically or manually from the cockpit.
- **Hook** can be released manually by ground personnel, though this is not often done.

The company says inspection of the sling and hook every 25 hr. is all the checking given it.

While the Sikorsky sling and hook is used, World Wide has also developed its own sling system which actually carries the load proper and, in turn, is fastened to the Sikorsky hook. Trouble had been encountered with lengthy loads, like piping and lumber, which tended to rotate and slip out of the sling.

These problems were solved by tying wind socks on to the tail-end of the load and by developing a new system of slinging. Two steel wire socks, covered with canvas, are slipped on to the ends of the load. Each sock is connected to the Sikorsky hook by cable. When lifted off, the wire socks grip the load tightly, eliminating all slippage. Actually, the majority of S-58 loads are flown in nets. The most common cargo —50 gal. tanks of fuel or oil—are carried in this manner.

Maintenance of the S-58s has not been a problem, even in the jungle, World Wide officials claim. In fact, the company has been able to reduce its maintenance staff. Pilots claim the helicopter is lifting its maximum payload "under the worst possible lifting conditions." No major adjustment has been made on the S-58s in order to adapt them to jungle work, except for the addition of a grounding wire. Since the S-58s fly several trips without touching down, a hefty static electricity charge is built up.

The grounding wire was added to keep from bowling over native crews.

Commercial Aspects

World Wide Helicopters Ltd. provides an interesting example of how one of the biggest commercial helicopter cargo operators is doing. For competitive reasons, few of these outfits are talkative. But World Wide Helicopters, with about 40% of its stock now in the hands of the public, is more cooperative. In fact, one of the first results of the company's initial public offering last fall was the change in the corporate name from Bahamas Helicopters Ltd. to World Wide Helicopters Ltd. The company's new stockholders thought the old name too restrictive, too suggestive of a lazy inter-island operation.

World Wide employs about 140 persons, representing 13 different nationalities. Its 45 pilots fly a fleet of 19 Bell 47Ds, two Westland S-55s and the three S-58s. In addition, the company operates 15 fixed-wing aircraft, with the PBY Catalina being the largest. Central operating office is Paris, though its reg

Dutch Test New Spray/Duster

Unusual fuselage profile marks new Dutch-built Hollandair HA-001 single-seat agricultural airplane which is designed to carry total of 80 gal. of chemicals in two wing tanks. Dust hopper installation is also possible behind pilot. Fuselage is of welded steel tube construction; wings are all wood. Powered by a 135-hp. Lycoming, performance of plane fully loaded is estimated as: stalling speed, 40 mph.; initial rate of climb, 1,000 fpm.; cruise speed, 80-90 mph.; landing and takeoff distance 110 yd. Airframe is designed to take engines up to 200 hp.

istered office is in Nassau, the Bahama Islands.

The company is a direct descendant of Armstrong-Flint Helicopter Co., formed in 1946 by two Americans, H. B. Armstrong, now company president, and Knute W. Flint, now secretary-treasurer. Each owns 24% of the outstanding shares. Started on an investment of $39,000, World Wide Helicopters, as of January 31, last, reported consolidated assets of $3,592,690. Its 1956 net amounted to $421,528 on a gross income of $1,633,250.

The 300,000 common shares sold by the company last fall, were offered at $5 a share and about 90% were bought by U.S. citizens. The stock, which carries a par value of one British pound ($2.80), currently is selling over-the-counter at 5¾.

World Wide Helicopters Ltd. is defined by its top managing officer, Arni L. Sumarlidason, as a "service company which offers aviation as an industrial aid." Sumarlidason, who can still recall earlier company days when he used to spend Sundays flying passengers in a Bell around Los Angeles to meet the company payroll on Monday, looks ahead to a bright future for World Wide. At present, the company is operating on contracts with oil companies in Papua, Borneo, Netherlands, New Guinea, Pakistan, India and Lybia. It probably will soon be flying another oil contract in Venezuela.

While World Wide, like most of its competitors, works almost exclusively for oil companies, the company looks forward to the day when its operation will have the capacity and capability to take on any job anywhere in the world. Sumarlidason now could sign a contract with an aluminum company if an aircraft existed that could lift 40 tons. The aluminum company is planning a large hydro-electric plant in a remote area, and cost for building just the last six miles of road into the site is estimated at $8 million.

PRIVATE LINES

Design studies on a high-wing six-place twin Lycoming-powered executive plane have been completed by French manufacturer Paul Aubert Co. Metal-and-wood construction will be used; landing gear will be retractable tricycle type.

New Beech Travel Air four-place light twin will list for $49,500 with full complement of flight and engine instrumentation. Dealers are now taking orders for the executive plane, which is coming off production lines in Wichita. Cabin sound is stated to be three decibels lower than that of Bonanza.

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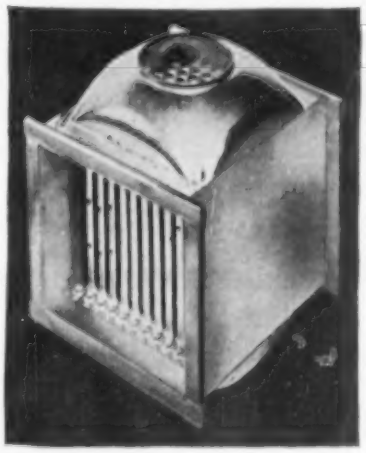

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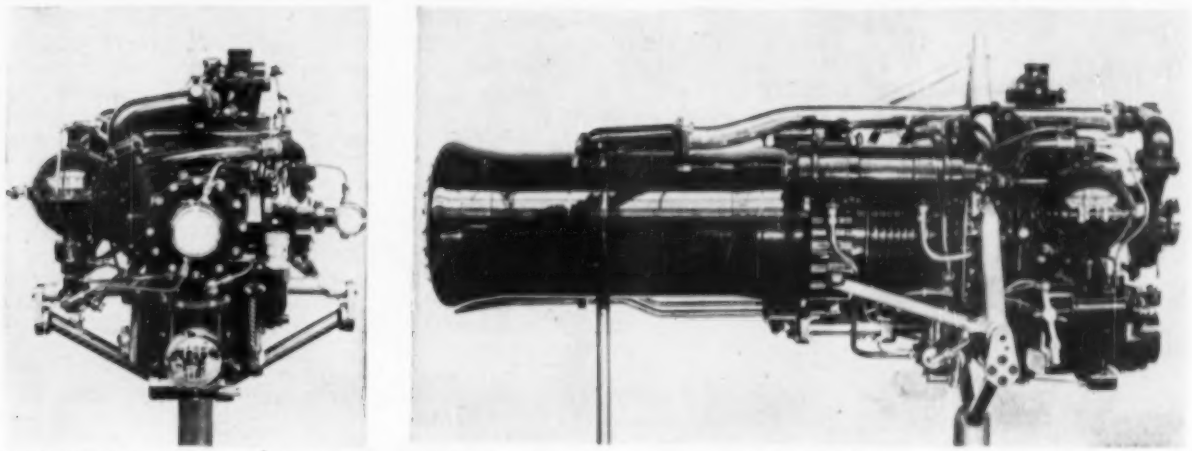


LOCATION OF PUMPS and oil cooler is shown in front (left) and starboard views of Spectre. Oxidant pump is on front.

Safety, Long Life Claimed for Spectre

London—Additional details of de Havilland's Spectre rocket engine, a variable thrust unit designed for manned aircraft, have been revealed.

Spectre is flying in the Saunders-Roe S.R. 53, a mixed powerplant research aircraft whose turbojet engine is an Armstrong-Siddeley Viper.

Safety Stress

De Havilland says the Spectre is a safe, reliable aircraft engine which can be run repeatedly for short or long periods of time and which is already capable of long life.

The Spectre employs kerosene as a fuel and high test hydrogen peroxide (HTP) of 83-87% concentration as oxidant. It is a lightweight unit 56.5 in. in length and with a maximum diameter of 32 in. with mounting and 26.5 in. without. Maximum thrust of the engine is 8,000 lb. This can be varied from 10% to 100% thrust by a cockpit throttle.

Engine can be shut down and restarted in flight.

Main structure of the Spectre contains in its forward section the turbine which drives the two centrifugal propellant pumps. Just aft of this is the catalyst chamber, followed by the combustion chamber and nozzle assembly.

The small high-speed steam turbine driving the pumps is started by a separate pressurized supply of hydrogen peroxide. Decomposed products from this drive the turbine and then exhaust directly through the main combustion chamber. After the engine is running, HTP is bled from the main propellant system to supply the turbine. Due to the internal exhaust arrangement, this is a low-loss system which has only a slight effect on the mass flow of the main propulsive jet.

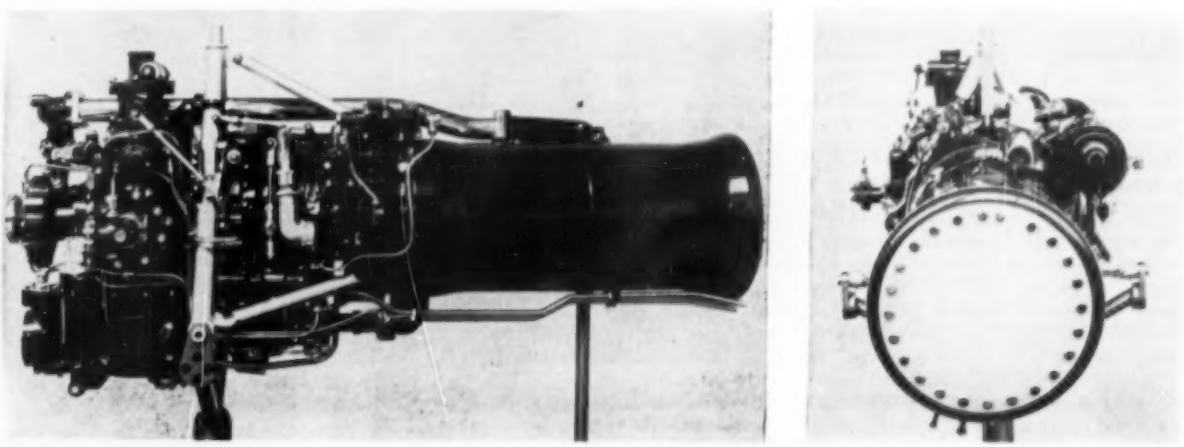
The pumps themselves, together with their gearbox, are mounted ahead of the main cylindrical structure, with the fuel pump on the port side and the larger oxidant pump mounted on the front of the engine.

Control Location

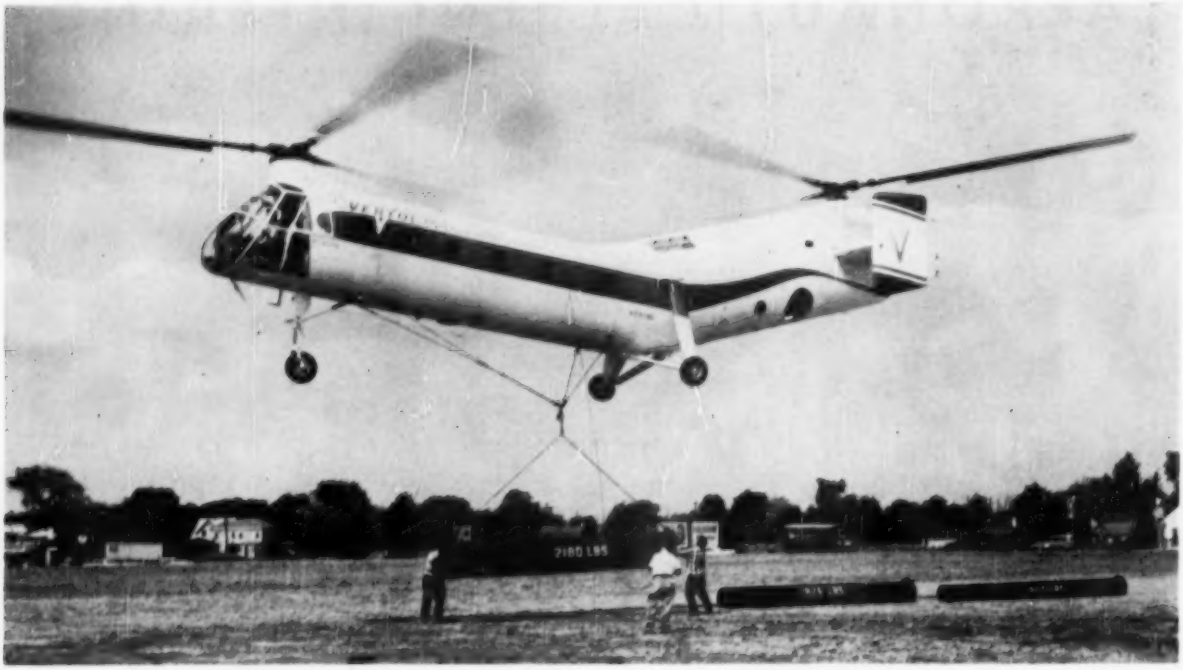
Oil sump is under the gearbox, with a fuel-cooled oil cooler on the starboard side. Majority of control valves and linkage systems are located on the port side but the HTP starter unit is on the opposite side.

The Spectre is an integral unit, without electrics, and after attachment to the aircraft requires little more than connection to the propellant tanks and hookup of starter and throttle linkages.

Bands seen on the center section of



CONTROL VALVES and linkage systems are on port side for most part (left). Plate covers nozzle of the engine (right).



Vertol Demonstrates V-44 to Oil Industry

Petroleum industry representatives were recently shown Vertol V-44As industrial capabilities in New York, including lifting and placement of heavy pipe, oilwell pumps and crews, prior to sending it on tour of offshore oil centers. V-44A, now in production at Morton, Pa., sells for $279,800; 15-passenger airliner at $294,800 with deliveries in 60-90 days.

the main structure are not cooling bands but are for strengthening.

HTP is ducted from its pump through a feed pipe on top of the engine, aft to the combustion chamber and nozzle where it is used for cooling before flowing into the catalyst chamber.

Since the flow of HTP varies with throttle setting, this cooling system provided one of the most difficult development problems on the Spectre, which operates at 2,300C. It was solved by diversion of flow to particularly critical areas during lower thrust operation.

Other particularly troublesome problems overcome by de Havilland Engine Co. engineers included development of a combustion chamber which would provide suitable mixing, mechanical development of pump drives and gearboxes, and sealing of HTP in its flow passages to prevent its mixing with oil, an especially difficult task in the pump.

Catalyst Chamber

After its use as coolant, the HTP flows forward into the catalyst chamber where it is injected ahead of packs of silver-plated gauze. These packs are contained between a forward plate with many dozens of needle holes and an aft plate with scores of larger openings.

Decomposed by the solid silver catalyst into a mixture of super-heated steam and oxygen, the HTP passes into the combustion chamber at 600C. Just downstream of the catalyst packs, kerosene is injected from a centrally-located nozzle outward into the surrounding combustion chamber. This atomized spray ignites thermally.

Mixture ratio of HTP to kerosene at 9:1 is constant throughout the entire thrust range.

"By decomposing the peroxide prior to its injection into the combustion chamber," says de Havilland, "safe smooth ignition of the fuel is obtained without the use of a spark or glow plug, and as a consequence one of the hazards of most types of rocket engines, the danger of a hard or explosive light-up is completely eliminated."

At the low end of the Spectre thrust range, the engine idles with 10% thrust from the HTP alone. This provides an added safety feature since during starting and shutdown, the purge of steam cleans out the combustion chamber, eliminating any hazard from an accumulation of fuel.

Use of silver as the catalyst can be detected from the colorless exhaust of the rocket engine. At low thrust, steam is ejected from the nozzle and as thrust is increased after ignition, an exhaust flame appears, showing the distinctive diamond shock pattern of a hot supersonic jet stream and varying in length up to 20-ft.

Bipropellant combination used in the Spectre has the advantage that combustion at other than the correct mixture ratio results in lower rather than higher temperatures. Thus, the engine is running at its hottest when the mixture is correct and any imperfect mixing results in "cold" spots in the combustion chamber rather that "hot" spots.

Variable Thrust

De Havilland says that in designing the Spectre the requirement for a variable thrust output could have been met by employing a multiple combustion chamber configuration providing incremental variations in thrust. But the single chamber providing a continuously variable thrust output and a high combustion pressure was chosen although initially it offered more development problems. Pressures, for example, can be in the neighborhood of 325 psi. at 5,000 lb. thrust.

In meeting the problem of cooling the combustion chamber and nozzle, water cooling was tried first. The engine ran under its own power for the first time in July, 1953—two years after the Ministry of Supply placed a contract for it.

It was run "cold"—i.e., at 600C on hydrogen peroxide only—during the following month. In September of that year, it was run "hot" for the first time. The Spectre attained its design rating in July, 1954, and three months later the water cooling system was discarded, a large step forward as far as tankage problems were concerned.

Then followed an intensive develop-

ment period when both "cold" and "hot" runs were made with only the integral HTP cooling system, a period marked by large numbers of burned out combustion chambers. But as an example of the long engine life now achieved, the company cites a continuous Spectre run of 70 minutes, in which the limiting factor was its consumption of HTP.

The engine flew for the first time in December, 1956, in a Nene-powered Canberra. The Spectre in this installation was mounted aft of the rear main bulkhead, with a large propellant tank carried in the bomb-bay.

Flight Test

First "hot" test of the Spectre in the air was made in January of this year and a flight test program is underway to explore its handling and performance characteristics over a wide range of speeds and altitudes.

This program will be supplemented by a second Canberra now being modified to carry a Spectre. Flight trials of the Spectre also are underway on the S.R. 53, which made its first flight in May.

De Havilland chose hydrogen peroxide as propellant for the Spectre over liquid oxygen and nitric acid for a number of reasons. Liquid oxygen, with a very low boiling point and rapid evaporation, was rejected as unsuitable for use in an interceptor aircraft which requires instant readiness for long periods and also because of the difficulties in dealing with its extremely low temperatures. Nitric acid was discarded as unsuitable for a manned aircraft due to its highly corrosive and toxic nature.

Despite the fact that it is expensive and requires special handling due to its mono-propellant characteristics, HTP was selected.

One of these was, in fact, considered an advantage. Since it contains energy of its own which can be released by a catalyst, HTP could be decomposed into steam and oxygen for driving a turbine.

First Whirlwind Mk. 7s Delivered

First batch of Westland Whirlwind Mk. 7 helicopters, first to be built in England specially for antisubmarine warfare, are lined up on an airfield at Yeovil after delivery to Royal Navy. Powered by Alvis Leonides Major, it is Sikorsky built under license.

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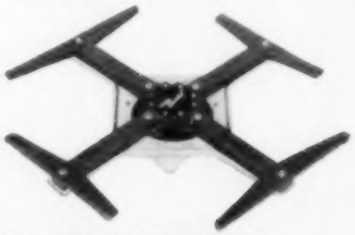

New LPA-70 flush-mounted loop antenna.

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Helicopter Flies Without Pilot

Controlled by radio signals from ground through cable, Kaman HOK helicopter flies without pilot. Control station is small, light and can be operated on ground or from another aircraft. Battlefield equipment, such as a TV camera, can be actuated remotely.

De Havilland turned this to advantage, just as it did the fact that HTP decomposition temperature was high enough to ignite fuel which could be injected to burn with the oxygen released.

Kerosene was considered the obvious choice for fuel since it would already be available in a mixed powerplant aircraft.

"At the same time, no danger is incurred if peroxide and fuel are inadvertently mixed outside the rocket engine's combustion chamber," said an official of the de Havilland Engine Co. "With the Spectre system, therefore, we feel we have retained all the combustion advantages of self-igniting fuels such as the Germans used in the ME 163 and the French are still using in the Trident without incurring the certain risk of an immediate fire or explosion if they accidentally mix."

Starting System

The fact that the pressure and temperature generated as part of the decomposition reaction can be harnessed to provide both an engine starting system and an auxiliary drive system means major auxiliary services can be provided without any secondary power supply.

Reduction of cooling problems as a result of the relatively low combustion temperature of the peroxide motor is cited as an advantage. In the case of the liquid oxygen rocket, de Havilland notes, cooling is a major problem, so much so that in the need for lower temperatures fuel/oxygen mixtures far from the optimum are likely to be used, reducing the efficiency of the motor.

"The oxygen motor has to incorporate an involved plumbing system, far more valves and an electrical system with spark plugs and micro-switches, quite apart from a separate source of energy for the various auxiliary services," the company adds. "Furthermore, it is obvious that if one has a liquid at −183C around in an aircraft then suitable precautions must be taken to ensure that controls, valves, etc., do not freeze-up during a waiting period."

HTP Disadvantage

Though denser than liquid oxygen, HTP is not as dense as nitric acid. Both these other oxidants also have the advantage of being much cheaper than HTP. One of the biggest disadvantages of HTP is the care that must be taken to prevent it from coming in contact with any of the many catalytic agents which will cause it to react.

De Havilland since 1948 has been advocating use of liquid propellant rocket engines as a means of providing manned aircraft with a rapid rate of climb and quick acceleration to maximum speed, as well as maneuverability at extreme altitudes.

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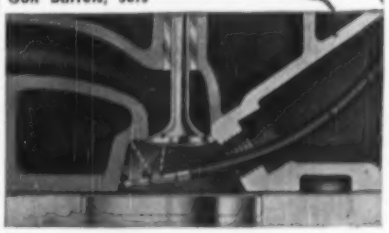

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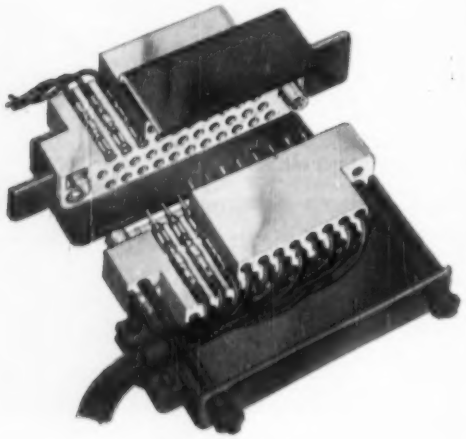

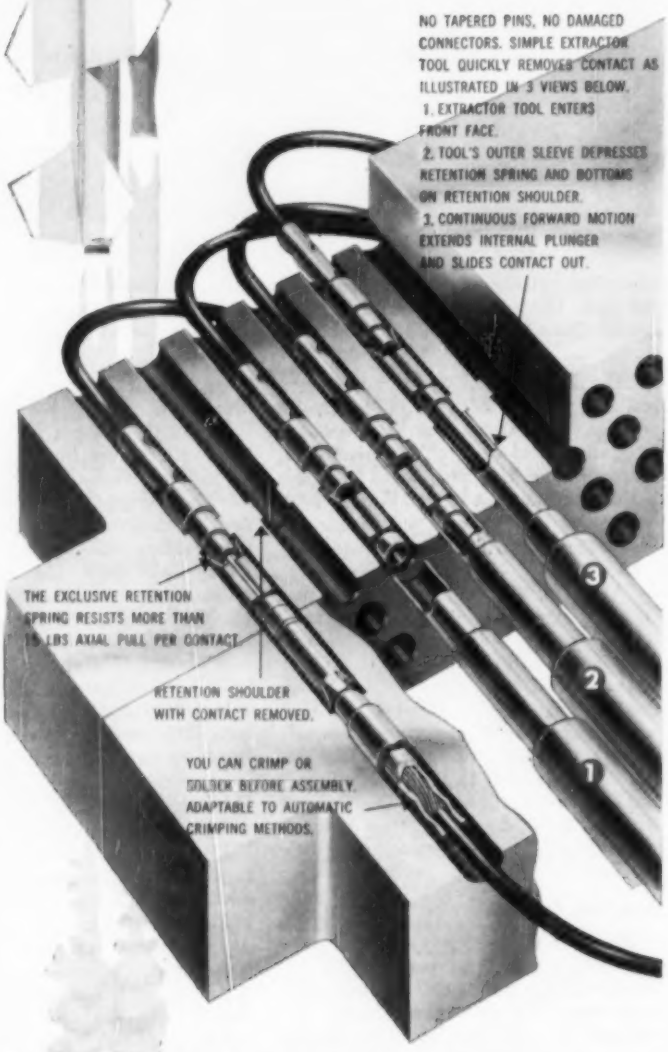
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design and development of a variable thrust aircraft rocket engine, de Havilland's main project in the field had been the Sprite assisted take-off unit for the Comet I. This was a self-contained unit using HTP as a monopropellant, supplying it from a pressurized tank which was an integral part of the engine.

De Havilland's Super-Sprite, developed from the Sprite, was an ATO unit which used kerosene with the HTP to increase performance. Super-Sprite employs tanks pressurized with nitrogen to force the propellants into the combustion chamber. It provides 4,000-lb. thrust for 40 sec. Super-Sprite now is in production for the Vickers Valiant bomber, which employs two, mounted in recoverable wing nacelles which are jettisoned after takeoff.

A constant-thrust version of the Spectre has been developed for the same purpose and for guided missile powerplants. This and the variable-thrust Spectre are in limited production.

Five marks of the Spectre thus far have been disclosed by de Havilland: D. Spe. 1, 3 and 5 variable thrust versions and D. Spe. 2 and 4 constant thrust units. Ministry of Supply contract for the constant thrust Spectres was received in 1953 and the first such unit ran in 1955.

British Army Develops Anti-Tank Missile

London—British army disclosed a new anti-tank guided missile with an accuracy which it says can be measured "not in yards or even feet but in inches." Missile, not yet in service, is guided visually onto the target with a remote apparatus resembling a combination of a steering wheel and a periscope. It was developed in Australia.

Improvements Slated For German Airports

Bonn—USAF has ticketed $14 million for the biggest U.S. military dollar expenditure in Germany since the end of the war.

Twelfth Air Force said the funds will be used to extend the 10th TAC Reconnaissance Wing's present runway at Spangdahlem to 10,000 ft.

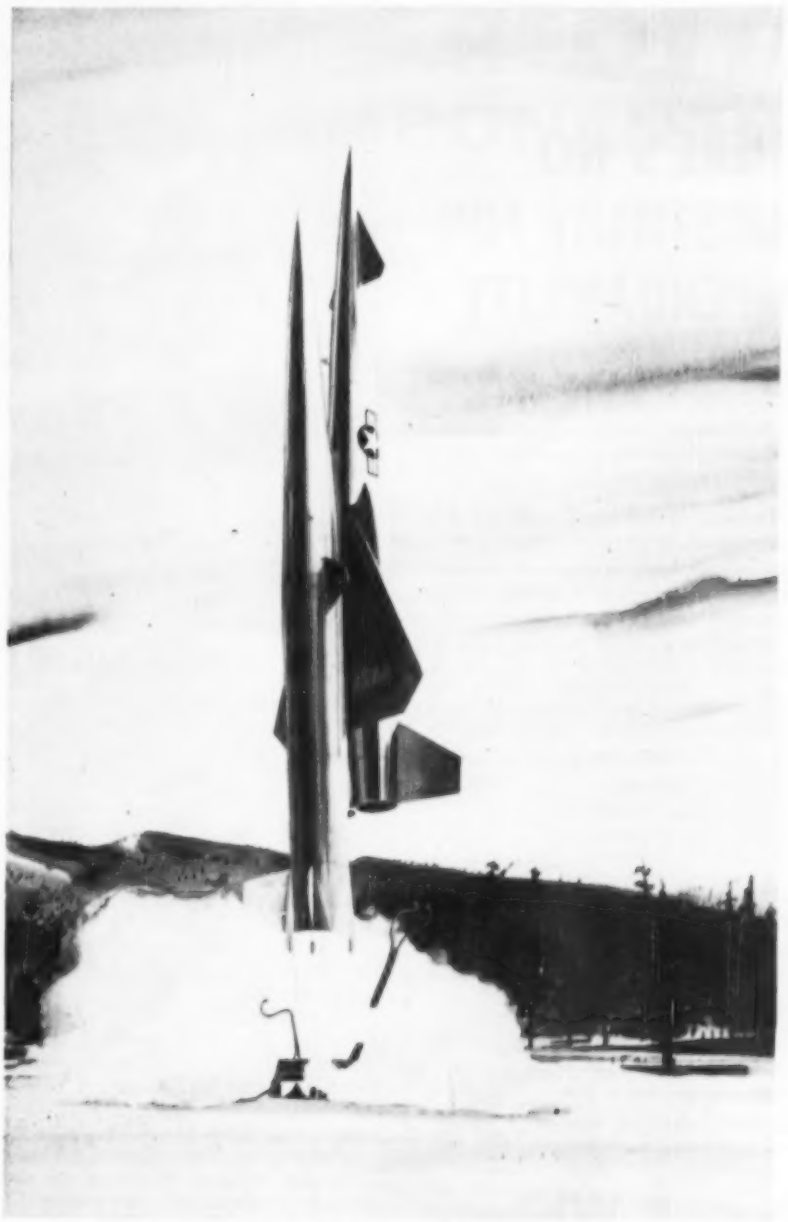
Provisions for spending U.S. dollars for construction in Germany were established by agreements in late 1956 between the German Finance Ministry and the U.S. Since the end of the war major construction has been paid for with Deutsche Marks originating from occupation costs, German Support Defense funds and Mutual Aid counterpart funds.

Work on the runway extension has started and is slated to be completed in 90 days.

Only seven other runways in Europe are currently in the 10,000 ft. category. Other runways west of the Iron Curtain and east of the Atlantic which are larger include those in North Africa at Ben Guerir (14,000 ft.), Nouasseur (12,200 ft.), and Wheelus, Tripoli (11,000 ft.). A facility at Lajores field in the Azores is 10,800 ft. long.

A 12th Air Force spokesman said the primary reason for the longer Spangdahlem runway is to handle more modern aircraft including the RB-66, twin-jet reconnaissance bomber, used by 10th TAC Reconnaissance Wing.

Should the aerial inspection plan proposed by President Eisenhower come into effect, the RB-66 operating from fields such as Spangdahlem would probably be tapped for part of the



XSM-64 Launching

Interim version of North American Navaho, the XSM-64 designated by company G-26, is drawn by artist as being launched. This version was successfully fired at Patrick AFB, Fla. Interim version still uses twin butterfly like tail of X-10 test vehicle. Booster has two 135,000 lb. thrust chambers developed by North American's Rocketdyne Division (AW Aug. 19, p. 29). Final version is designated SM-64A (AW Aug. 26, p. 32).

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Navy Mixes Two Generations

Navy's last piston engine fighter development, Grumman F8F Bearcat is shown in flight with its latest Grumman successor, F11F-1 Tiger. Supersonic F11F, powered by Curtiss-Wright J65 turbojet, is undergoing carrier evaluation.

job. Contracts processed under U.S. German construction agreements are awarded directly to the German Finance Ministry which in turn selects a contractor mutually agreeable to both governments.

U.S. Air Force control of West German airports has become an election-year issue.

In a letter to Chancellor Konrad Adenauer, the chief executive officer of the State of Hesse has demanded that USAF turn over its part of Frankfurt Rhein-Main Airport, West Germany's biggest, to the Germans.

Minister-President George August Zinn has released the text of the letter he wrote to Adenauer asking the federal chancellor to back a free-the-airport drive. He says he has not received a reply to date.

Adenauer is leader of the majority Christian Democratic party. Zinn is a member of the Social Democrats, the country's chief opposition party. National elections are scheduled for September 15.

The Frankfurt Airport has one runway under U.S. military control for the use of MATS, the other under federal government control for the use of civilian planes.

In his letter, Zinn advised Adenauer that his state government has information USAF plans to expand its runway to handle jets. He added that according to his information, the Bonn government had agreed to it.

A spokesman at the Federal Ministry of Transport denied that such an expansion had been agreed to, claiming the request had not even been made.

A USAF spokesman said that if such an expansion is being planned, it is at a higher level than the European command one. However, he added that the Air Force does not plan to release Rhein-Main and that no German request to this effect has been made.

Zinn's letter is seen as an election

maneuver in the vigorously contested campaign. It is also part of a running battle between Frankfurt and Bonn for top place among West Germany's civil airports.

With the Wahn Airport, halfway between Bonn and Cologne, now officially released from British control, the Frankfurt boosters are worried that an all-civil airport will have an edge over a mixed military-civilian one.

Federal Transport Minister Hans-Christoph Seebohm probably had these fears in mind this week when he said he believes the civilian side of Frankfurt Airport will be the first in West Germany to handle trans-oceanic jet passenger planes. He said he did not think Air Force planes would interfere with jet passenger planes because the Air Force has its own runways.

The civilian-controlled runway has been extended from 7,000 ft. to 9,842 ft. but the additional length will not be opened until September 1. Transport Ministry officials say that another 1,968 ft. can be added within three to four months in order to accommodate jet transports.

United Aircraft Plans $2,500 Engineer Prize

East Hartford, Conn.—To encourage technical advancement in all divisions of the United Aircraft Corp., a medal and a $2,500 prize will be awarded annually by the company for the outstanding engineering accomplishment by a company engineer.

Members of engineering staffs of United's three divisions, Pratt & Whitney, Sikorsky and Hamilton Standard, are eligible. No rigid rule will govern the selection and every engineering activity, large or small, will be considered.

Award will be named after the late George J. Mead, one of the organizers and engineering head of Pratt & Whitney when it was founded in 1925. He designed Pratt & Whitney's first radial air-cooled engine from which evolved the Wasp series.

880 Requires Special Camera for Templates

Huge template camera has been acquired by Convair San Diego Division of General Dynamics Corp., for work on its 880 jet transport.

Built by Robertson Photo-Mechanix, Inc., Chicago, camera is 30 ft. long, 8½ ft. high and 7 ft. wide, weighs more than 10,000 lb. It will be able to reproduce templates ranging up to 5 x 12 ft. and within 1/200-in. tolerances. Unit uses 42-in. film or plates, is focused manually or electrically with mechanical-electrical interlocking feature.

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Size	Stall Torque	No Load Speed	Watts Phase	Weight
8	.33 oz. in.	6200 RPM	3.4	2.1 oz.
10	.28 oz. in.	6500 RPM	3.1	1.5 oz.
11	.63 oz. in.	6700 RPM	3.5	4.5 oz.
15	1.53 oz. in.	5300 RPM	6	7.30 oz.
18	2.4 oz. in.	5300 RPM	9	12.2 oz.

TRANSISTORIZED AMPLIFIERS

A new transistorized servo amplifier suitable for driving size 8, 10, 11, and 15 servo motors is also available. This amplifier provides a 40 volt, 6 watt output. Designed to meet the requirements of MIL-E-5400 it is rated for operation over the ambient temperature range of −54°C to +71°C. Two captured screws and a recessed connector are supplied with unit. Dimensions 1 9/16" x 1 3/16" x 1 3/16" high, weight 4.7 oz.

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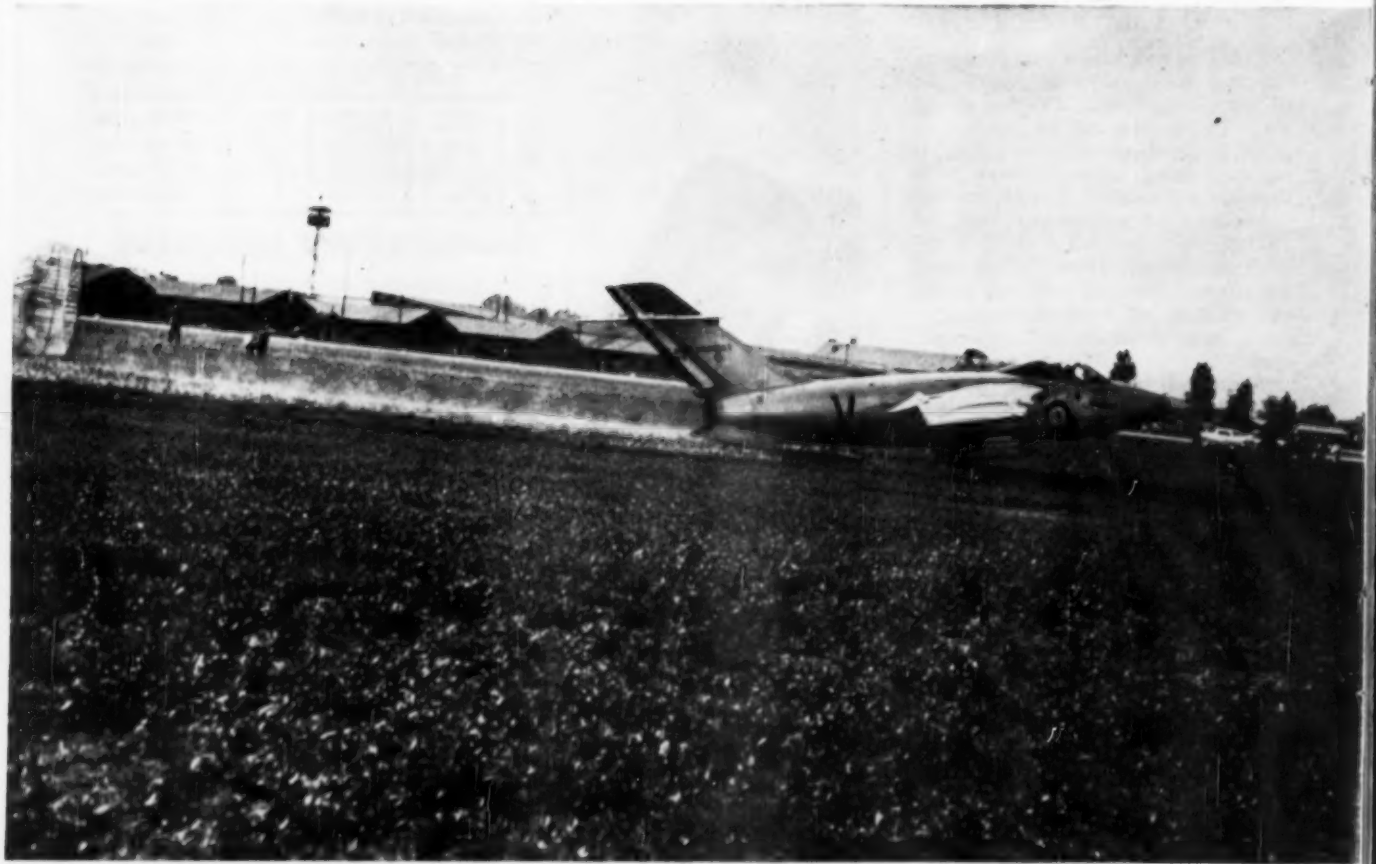
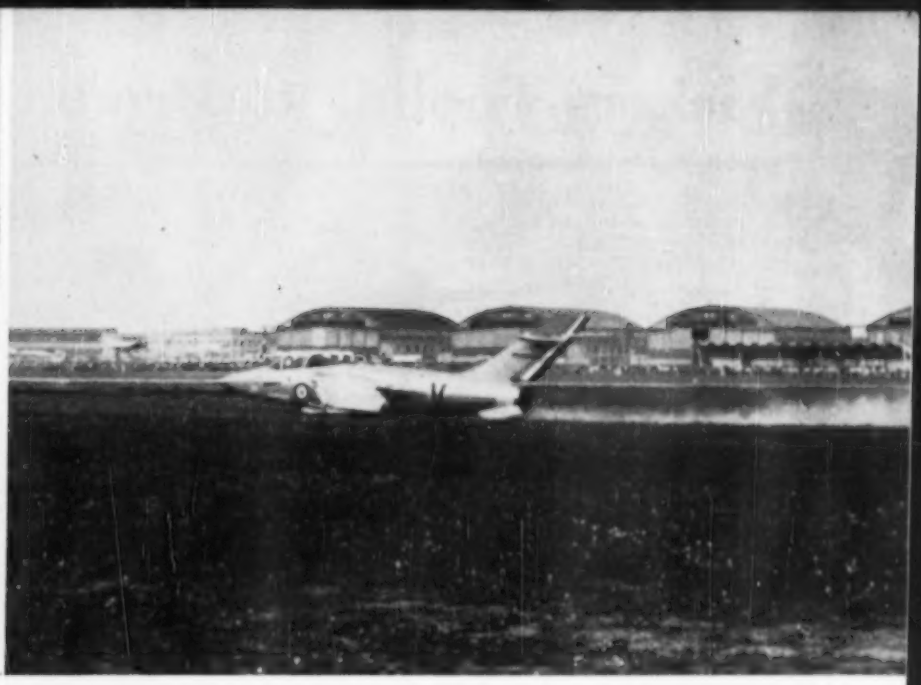
TAKEOFF run of the Sud Aviation Baroudeur is shown in the photo sequence above with USAF test pilot Maj. Arthur Murray at the con- fighter uses magnesium skids for takeoff from grass field in 3,300 ft. with full 13,500 lb. gross. It is powered by 8,100 lb. thrust Atar

Baroudeur Stresses Rough Field Capability



BAROUDEUR lands on grass field with ribbon type braking chute extended and skids just ready for touchdown. Note small flap area, extended leading edge slats and ventral fins near tailpipe.



trols. Latest S. E. 5004 version of the French 101E4 turbojet.

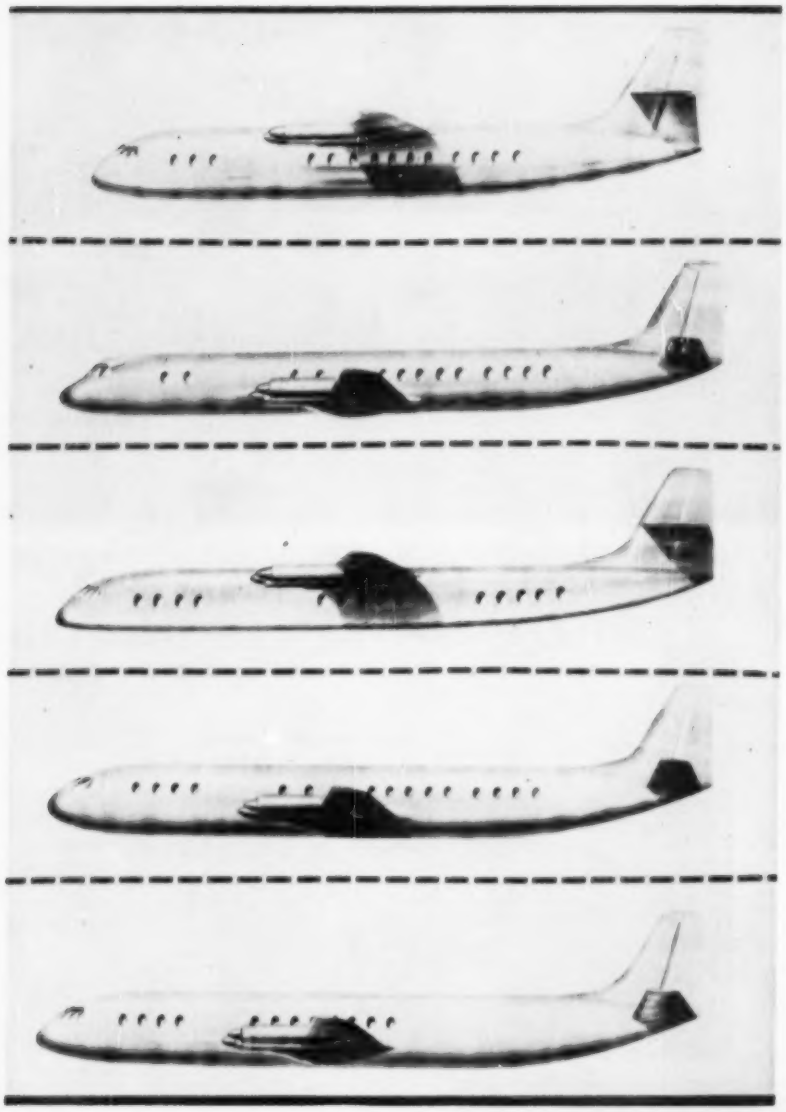
in NATO Race

Paris—Sud Aviation's latest version (S. E. 5004) of the Baroudeur skid landing ground support aircraft is a strong competitor in the new NATO lightweight fighter competition scheduled to be held in France late this month. The S. E. 5004 recently has been flown by a variety of international test pilots including Maj. Gen. Albert Boyd and Maj. Arthur Murray, USAF test pilots. It is powered by a Snecma Atar 101E4 turbojet delivering just over 8,000 lb. thrust with a specific fuel consumption of 1.06 and engine weight of 2,200 lb.

The S. E. 5004 grosses 13,500 lb. for takeoff and carries 530 gallons of jet fuel. It can fly at Mach .93 at sea level and has a top speed of 620 knots. With full combat load, it can take off from unimproved grass or dirt fields in 3,300 ft and land on its skids on similar terrain within 1,500 ft. after touchdown. It carries a variable armament including two 30 millimeter cannon; two 500 lb. high explosive or napalm bombs or two multi-cluster rocket launching packs. Baroudeur landing skids are made of magnesium fitted with expendable steel shoes that are easily replaced. Braking during the landing is obtained from retractable hooks controlled by the pilot and designed into the rear portion of the skids and a ribbon type parachute. Latest version of the Baroudeur also uses two ventral fins to achieve greater stability and leading edge wing slats. Designer of the Baroudeur is W. J. Jakimuk who is now sales manager for Sud Aviation's Caravelle jet transport.

BAROUDEUR (top) comes to rest after skid landing run of about 1,500 ft. Ground mobility for fighter is provided by special trailer (bottom) onto which the aircraft can be winched for transport and servicing.

Vickers Tooling to Produce Vanguards



Weybridge, England—One of the largest tooling programs ever undertaken for a European-built aircraft is well under way at Vickers-Armstrong (Aircraft) Ltd. for the turboprop Vanguard airliner.

Vickers estimates the total market requirement for the Vanguard at about 250 aircraft and is tooling up for four-a-month production. Initial production will be at a three-a-month rate in 1960.

British European Airways and Trans-Canada Airlines have ordered 20 each of the big turboprops, which are powered by four Rolls-Royce Tyne engines. First BEA aircraft is scheduled for delivery in the spring of 1960 and TCA will get its first Vanguard in the fall of that year. Next customer in line is being offered 1961 delivery.

No Prototype

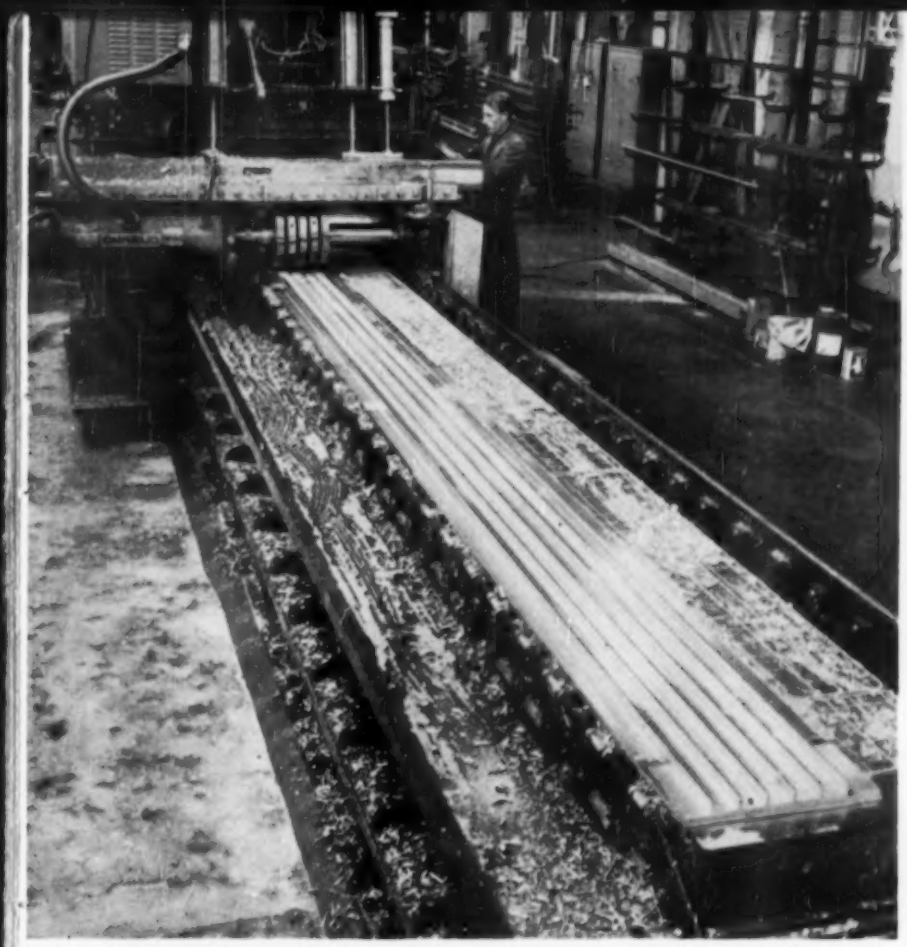
There will be no prototype. The first aircraft is being built on production jigs and already is taking shape. Fuselage assembly is to be completed in December, with wing mating scheduled immediately thereafter. First flight is set for September of next year.

Production planning for the 76-128 passenger Vanguard presented an entirely different set of problems to Vickers than did the smaller Viscount, on which sales are now approaching the 400 mark. But the firm was able to draw on big-aircraft experience gained in building the Valiant bomber.

The 410-mph. Vanguard, in fact, is being phased into the same building at Weybridge which turned out the Valiants, on which production is now ended. More than 300 draftsmen were at work on the Vanguard tooling program at one point and the results of their labors can be seen in the huge jigs now going up on the concrete floor as Valiant jigging comes down.

SIXTY project studies were made for the Vanguard with these five as finalists. High wing designs, with disadvantage of gear stowage problem, were killed by Trans Canada Airlines opposition based on servicing; ditching disadvantages. TCA also objected that with high wing airplane, pilot would not be able to see whether snow had been swept clear from wings, an important consideration in Canada.

COCKPIT mockup of Vanguard is for British European Airways airplanes (right). Seat for third crew member is visible in foreground.



STRINGERS for Vanguard's wing panel are milled on an Onsrud A.90 spar milling machine. Table of machine is 45 ft. long and 3 ft. wide. Carbide tipped milling cutters are of adjustable inserted tooth type.

PRODUCTION

from the skin line inwards. The cockpit section and center section are exceptions to this but here a profile control is used at the jig extremities to insure even mating with the other sections.

A 200-ton Hufford stretch press is used to stretch Vanguard fuselage panels and smaller Huffords for the frame sections. Fuselage is built up from pre-assembled panel-and-stringer sections. Skin is flush riveted to stringers.

Largest of the assemblies are the forward and aft fuselage sections. Each of these is built in two halves, with top and bottom panels being added at the second stage of assembly to form the completed fuselage section.

Half Sections

Each of the "half bodies," as Vickers calls them, is built from 16 of the pre-assembled panels. Frames in most cases stand on top of the stringers and are cleated to the skin with no cutout in the frame. Cleats, rather than the frames, are cut out at the stringers. There is about a 20-in. pitch between frames and 4-5 in. between stringers.

Windows, which are the 19 in. x 26 in. elliptical shape as in Viscount, are set at a basic 39 in. pitch. There are close-pitched vertical members between the windows and the last complete stringer running past the windows both top and bottom has a fishplate

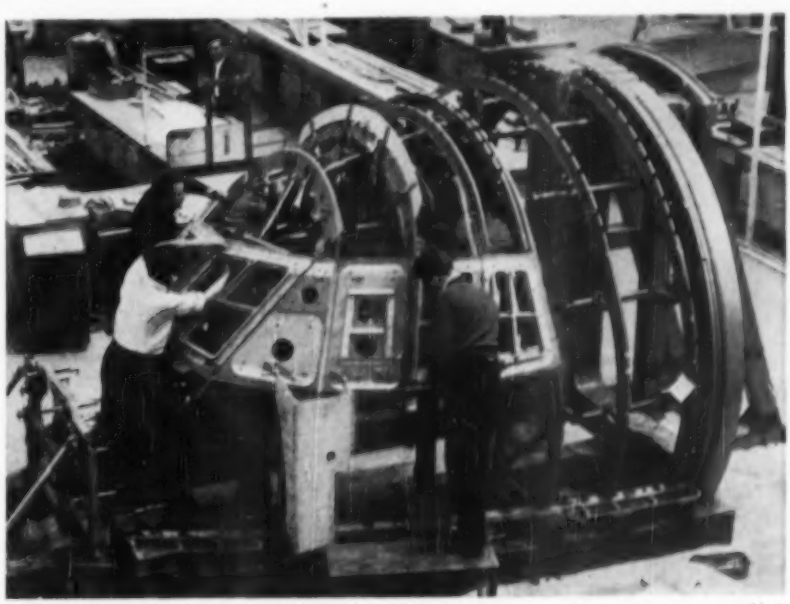
With a fuselage length of 122.8 ft. and a wingspan of 118 ft., the double-bubble Vanguard will be one of the largest airliners in the air. This is reflected in the 20 ft. high cast-iron fuselage jigs at Weybridge.

Fuselage assembly of the Vanguard takes place in three major steps:

- **Construction** of five subassemblies—cockpit section, forward fuselage section, wing center section, aft fuselage section, and tail cone.
- **Cockpit** joined to the forward fuselage section and the tail cone to the aft fuselage section.
- **Union** of these three major subassemblies to form the completed fuselage, an event that doesn't occur until almost two-thirds of the way down the assembly line. The wing is added later. This method enables both the fuselage and wing to be carried to an advanced stage before joining.

The method of construction is entirely different from that of the Viscount, where the fuselage is assembled in one jig.

Major assemblies of the fuselage were decided upon in a manner enabling construction to be as much as possible



TOP HALF of Vanguard cockpit assembly is put together on jigs. Cockpit assembly is exception to most of Vanguard fuselage construction that is designed to be as much as possible from skin line inward.

The emphasis is shifting

It used to be that you would design an airframe for payload—and provide *minimum* required instrumentation.

The emphasis is shifting.

In this new age of electronic missile guidance and identification, the chicken is now the egg and the cart pulls the horse. Instrumentation comes first—after which a mobile container is designed that will carry it with greatest efficiency.

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which picks up these verticals.

For stiffness there is a "tophat" (omega) section around each window with a fishplate which picks up on the frames alongside the windows. Although there are separate cleats at all other frame and stringer junctions there is a continuous cleat in the window region.

There is doubling around the door areas and, at some points, tripling, with the basic skin and two doubles.

The floor member provides the tie between the upper and lower bubbles of the double fuselage.

Tail cone is built as a single unit while the cockpit is built in two halves split at the floor level. The nosewheel bay is an unpressurized box in the nose section.

This differs from the Viscount in which the whole underside of the nose section is unpressurized. Unpressurized areas in the Vanguard, in addition to the nosewheel bay, are the nose radome and the tail cone.

Center Section

Fuselage center section, where the wing joins the fuselage, is built around a wing torsion box whose three shear webs are hung onto the three main frames. Although the wing torsion box itself is pre-assembled, this section of the fuselage is built as a complete assembly with no pre-stressed skin.

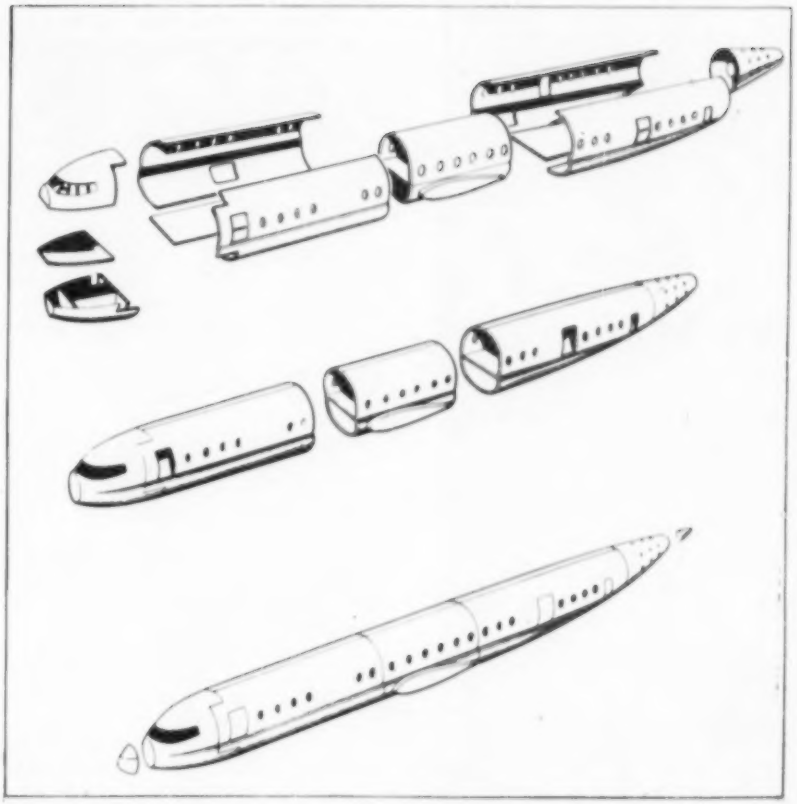
Three main frames which carry the shear webs are forgings to the point where the load drops off and then return to the fabricated assembly of other frames. There is more extensive cleating here than in the fore and aft fuselage sections.

Torsion box itself passes, of course, below the flooring and the stubs from the shear webs extend outside the fuselage slightly to pick up the wing sections.

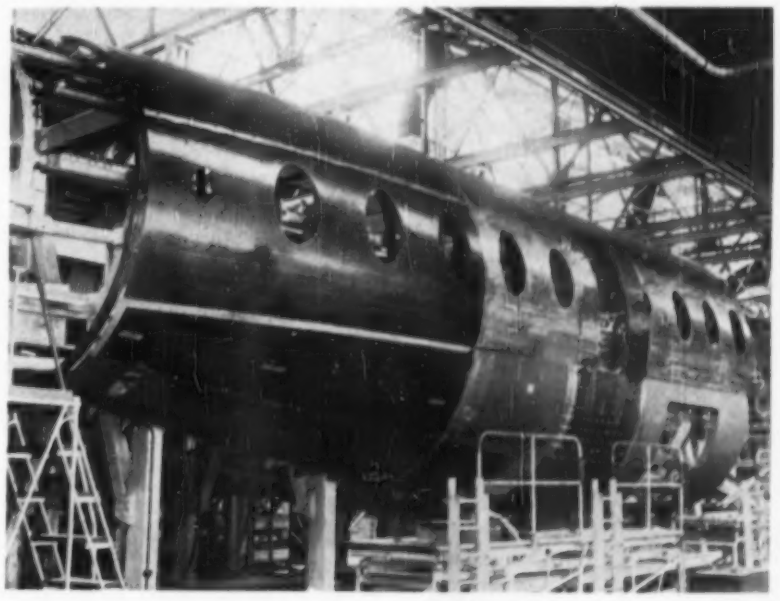
A crawlway provides access into the torsion box through the forward web and from there to the integral tanks in the wings. Systems and ducting pass under the torsion box.

There is an electrical bay forward of the box and a hydraulic bay aft. Access to these is through cutouts in the bottom of the fuselage. The hydraulic bay is a self-contained compartment which is pressurized at a slightly lower pressure than the 6.5 psi. working maximum of the cabin. By pressurizing the hydraulic cupboard slightly below 4 psi., a bleed is provided into the bay which prevents cabin contamination.

The three shear webs which form the two-bay torsion box carry throughout the wing. Integral construction is used for both top and bottom surfaces of the wing torsion box, with leading and trailing edges and tips being added after the box is joined to the fuselage. This differs from the Valiant procedure in which the wing is assembled as a unit.



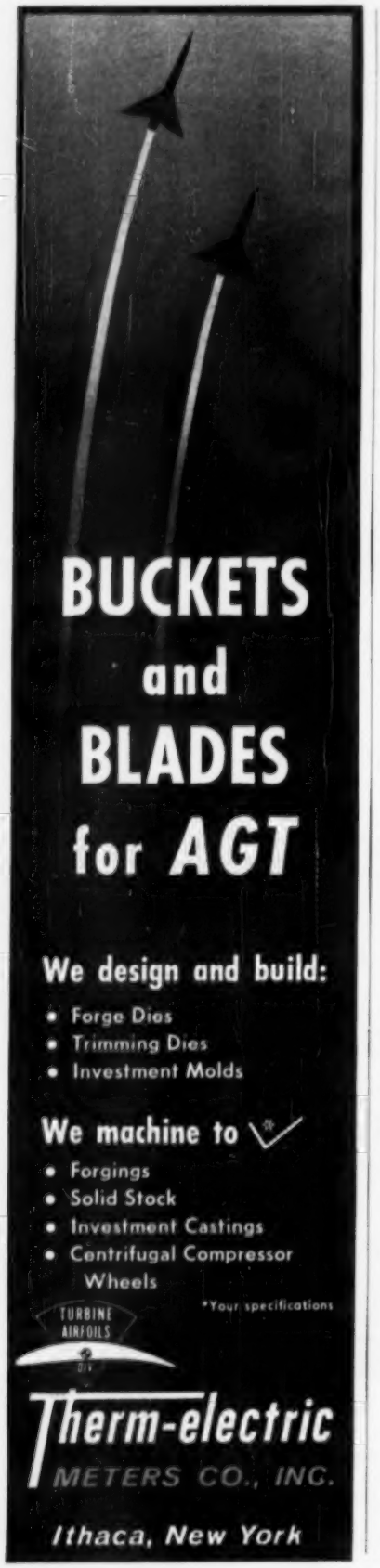
FUSELAGE ASSEMBLY whole and half sections is drawn (above). One of partly completed half bodies on jig is shown below.



Each wing contains, on its bottom surface, two constant and two tapered main panels, and two constant and two tapered outer panels. The top surface is the same except for providing four cutouts for access to the inner tank. Access to the outer wing tank is through removable panels in the leading and trailing edges.

The two inboard integral tanks of the Vanguard carry 2,220 U.S. gallons each and the two outer tanks 840 U.S. gallons each.

Altogether, there are 54 panels of



varying shapes used in the construction of a Vanguard wing from tip to tip. These are milled from stretch leveled panels which vary from 12 to 29 ft. in length, from 27 to 30 in. in width, and from 1¾ to 2 in. in thickness. Upper panels are D.T.D. 5020 and lower panels 24ST4.

The panels are first surfaced on a Cramic machine designed for the job. The stringers then are milled out on an Onsrud A.90 spar milling machine which has a table 45 ft. in length and 3 ft. wide. Carbide-tipped milling cutters are of the adjustable inserted tooth type.

Edge profiling is done on a Cramic profiling machine which has a table 42 ft. by 6 ft.

After milling, the skins are curved by hot forming and shot peening. The forming is done on a Vickers-designed machine built by Alltools Ltd. The shot peening is done on a Tilghman machine which uses 0.011 in. diameter steel shot. Rate of feed through the shot produces the desired degree of curvature.

In construction of the wing, the shear webs are built up separately and then the wing torsion box is assembled in the main wing jigs.

Since the wings are machined, they will be painted. It is therefore planned to paint the entire aircraft and an experimental paint job now is being applied to a Viscount in anticipation of this Vanguard requirement.

In view of the integral construction employed in the wing, it is interesting to note that the Vanguard came close to being a high-winged aircraft. It was designed originally to specifications laid down in 1953 by British European Airways and BEA favored a high wing as a result of its favorable experience with Elizabethans.

High Wing Studies

"An immense amount of work was done on high-wing design studies," Vickers spokesman said. "Not only were the airplanes drawn on paper, but preliminary weight and stress calculations were made and performance and economy analyzed for each study. Some very interesting high-wing aircraft were evolved."

Trans Canada, which entered the picture at this time, put forth some strong arguments against the high wing, however.

TCA insisted that a high wing would not be acceptable in the U.S. and Canadian market, that it presented many servicing problems, increased ditching risk, and made it impossible for the pilot to see from the cockpit whether the wings were free of snow—an important point to Trans Canada.

So the low-wing design was adopted. Consideration also was given to making the Vanguard a pure jet but turboprop economy won that point. Freight demands produced the double-bubble fuselage, with its two large freight holds below the passenger deck.

From a semi-final field of five designs, the choice was made in April, 1955, of the aircraft which is being built today at Weybridge. BEA placed an order for 20 in 1956 and this was followed in January of this year by a TCA order for 20 with an option on four more.

TCA said it placed its order only after an "exhaustive analysis" of all types of American and British aircraft on order for the 1960s.

According to Rolls-Royce the stage 1 Tyne will be available in 1959 to provide a Vanguard cruising speed of 410 mph. Stage 2 Tyne (1961) is to give 425 mph. while stage 3 Tyne (1963) will have a corresponding cruising speed of 440 mph.

Various Configurations

Vickers is offering the Vanguard in a 76-passenger first class configuration, 86-passenger mixed version, 93-passenger tourist layout, and 128-passenger coach configuration.

Aircraft is designed for ranges up to 2,600 miles. Maximum gross takeoff weight is 141,000 lb. Payload is 24,000 lb. Vickers notes that approximately two-thirds of the Vanguard's payload can be carried in the underfloor holds, providing freighter operation without modification of the passenger cabin.

The two holds provide a total volume of 1,410 cu. ft. The forward one has a 28 ft. length and the rear one, 22 ft. 8 in. Both have an interior height of 4 ft. 3 in. Loading doors are 5 ft. 6 in. by 3 ft. 10 in. The doors are vertically opening "clamshells" with the two halves counterbalanced.

Loading is at truck-bed height.

Studies have been made of an all-freight version of the Vanguard which would have a 7,110 cu. ft. capacity for 40,000 lb. of cargo carried in three compartments, the main cabin and the two lower holds. In this aircraft, the rear passenger door would be replaced by a large freight door measuring 5 ft. 10 in. high by 9 ft. wide. Vickers estimates the Vanguard freighter would achieve operating costs of 4.9 to 5.5 cents per ton-mile.

There are four main doors in the passenger cabin of the Vanguard—two entrance doors located fore and aft on the left side, each fitted with folding stairs, and two emergency exit doors on the right hand side which double as service entrances to the galleys. In addition, there is a third emergency exit door on the left side at the rear of the fuselage.

Two cabin window emergency exits are placed on each side over the wing and windows next to the main pas-

senger entrance doors and also serve as emergency exits.

Accommodation is provided in the Vanguard 950 cockpit for a flight crew of three. There is no flight engineer's station but the third crew seat, to the rear of and between the pilots, provides access to engine, propeller, landing gear, flap and trimming controls situated on the control pedestal.

Conventional flying controls are manually operated by push-pull control rods. For parking control surfaces can be locked mechanically from a lever on the control pedestal. A restrictor bar connected to this lever does not permit sufficient power for take-off with the locks on although it allows power for taxiing.

Flaps are Fowler type fitted in four sections per side and connected by bogies which move on rollers in steel guide rails. They are hydraulic.

The Vanguard's tricycle landing gear has twin wheels on both nose and main gear. Since the gear retracts forward, there is a free fall emergency lowering system. Main gear retracts into the inner engine nacelles.

The Tyne engines drive four-bladed de Havilland 14 ft. 6 in. diameter, constant-speed, fully-feathering propellers.

First Vanguard produced will be used for extensive flight testing but the company plans ultimately to sell it. After flight of the initial aircraft in September, 1958, the second aircraft will come off the assembly line in November/December. These will be followed by four more at about three month intervals during 1959 and certification testing will be carried out all through that year. BEA then will take delivery of its first aircraft early in 1960, with Trans Canada receiving its first Vanguard in the early autumn of the same year.

PRODUCTION BRIEFING

American Aerophysics Corp., El Segundo, Calif., added a Fiberglas Division. The new division plans to produce Fiberglas-reinforced plastic laminates for jet vanes, rocket exhaust nozzles, aircraft wing and fuselage structures, missile fins and control surfaces, radomes, access doors, and external stores. Laminates will be adapted to high temperatures.

Aeronca Mfg. Corp., Middletown, Ohio, said a $400,000 Onsrud spar milling machine has been installed as part of the new equipment needed for airframe subcontracting. Among present and contemplated programs are parts for the KC-135 tanker, 707 commercial airliner and improved B-52G, all for Boeing Aircraft Corp. The spar mill will take 60 ft. long pieces and can eventually be converted from template control to numerical control by tape.

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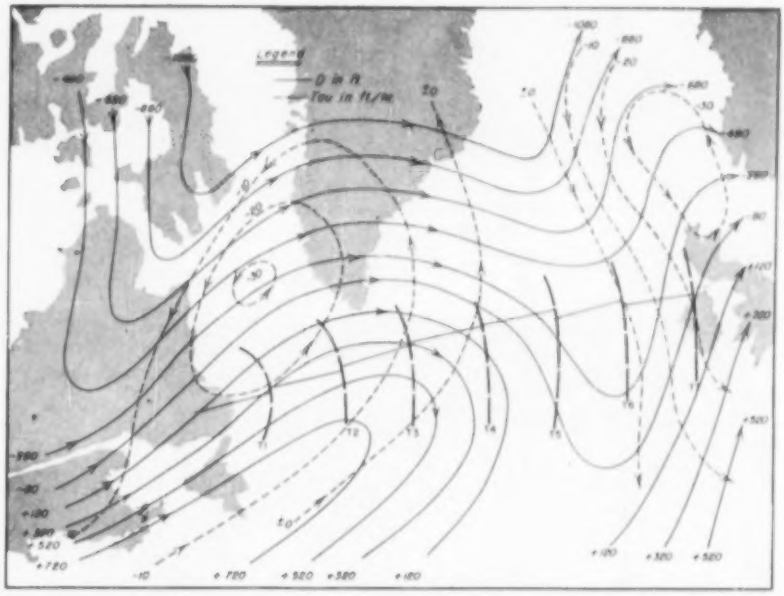
MATS Tests 4-D Navigation in Pacific

By Russell Hawkes

Hickam AFB, Hawaii—Four-Dimensional Optimum Flight Planning Navigation is getting mixed reaction from Military Air Transport Service, only carrier which has used it operationally. The highly refined pressure pattern navigation technique can extend range or cut fuel requirements by 10% or more on many routes.

Air crews and meteorologists in the Pacific Division of MATS are generally in favor of the optimum technique. Reduction in fuel consumption has never approached 10% in the Pacific but is still thought to add up over a period of months to a significant saving. Other benefits have been an apparent improvement in accuracy and consistency of forecasts, and better teamwork between operations and weather people.

But a question sometimes asked is whether the benefits are great enough to match the expenditure of extra manhours in preparing 4-D analyses and optimum flight plans.



OPTIMUM flight planning used on an Atlantic flight. Chart shows indicated headings between time fronts on a flight from Goose Bay to Prestwick.

ARDC Contract

The technique was developed by Cook Research Laboratories of Chicago under a contract awarded by Air Research and Development Command. A modification for Strategic Air Command is now being developed.

The four-dimensional analysis, as its name indicates, represents large scale atmospheric pressure variations continuously in latitude, longitude, altitude and time. Winds can be derived for any point on the analysis by reference to the known relationship between wind flow pattern and pressure pattern. The pressure pattern at a time several hours in the future can be figured by linear interpolation between a forecast and the current analysis.

Optimum flight planning uses the four-dimensional analysis, a special hand computer and a simple technique to draw from pressure data the minimal time track. Use of digital computers, improved long range communications and tie-in to numerical weather prediction will increase effectiveness.

The 4-D optimum technique is expected to reach its full value with the advent of turbine powered aircraft because of the critical importance of fuel economy in their operations. Several commercial carriers with long overwater routes and jet transports on order have sent representatives to the MATS Optimum Flight Planning School here to study the technique for possible adoption.

The accuracy of any pressure pattern navigation method decreases in low latitudes and within 20 deg. of the equator is so slight as to make the method useless. Air Force Cambridge Research Center is currently seeking a way of fitting the lower latitudes into the 4-D optimum flight planning technique.

MATS Pacific Divisions routes reach into what is probably the most unfavorable area yet to be flown operationally using the optimum technique. Keystone of these routes is Hickam, located almost precisely at 20 deg. north latitude. The great expanse of the area, sparsity of reporting points in the weather observation net and the flatness of pressure gradients during the summer months all contribute to the difficulty of operating on optimum. In winter, when pressure gradients and hence winds are stronger, the payoff is somewhat greater. The division would like to fly directly from Tokyo to Hickam, skipping the usual fuel stop at Midway. This would produce a considerable saving in time and expense. According to the 1st Weather Wing based in Japan, this is impossible in summer and possible in winter only with the use of optimum flight planning.

Experience has shown that the optimum track often lies quite close to the great circle track or the rhumb line track on Pacific routes. To save manhours, the division has adopted a modified method using six selected tracks between Hickam and the MATS West Coast terminal at Travis AFB, and 13 selected tracks between Hickam and Tokyo. On the basis of each new synoptic analysis, an optimum track is plotted for each route and all flights are dispatched along the closest selected track until the next periodic synoptic analysis is released.

An hour and 20 minutes is required to make an optimum flight plan while only 20 to 25 minutes is required to make a selected track flight plan. The selected track plans are pre-printed and the problem is largely reduced to one of card indexing. Since the track selection is based on an optimum plan, some of the advantages of optimum remain. AFCRC is working on modifications of plotting aimed at making pure optimum more economical in time.

Weather Data

Meteorologists feel that the percentage increase in fuel economy could be substantially raised if the number of weather reconnaissance flights over the ocean were doubled. This would increase the density of reporting points contributing to analyses and thereby improve the accuracy of forecasts. The purpose of the technique is to get the best possible use out of available weather data no matter how limited. But forecast accuracy is now less than the potential precision of the optimum flight planning method on which the 10% figure is based. This being true, forecast accuracy is an important limit-

ing factor on the advantages to be realized from the technique. If it is improved it might justify a return to pure optimum even without anticipated improvements.

Rigid air traffic clearances and the difficulty of radio communication over the long distances involved tend to prevent crews from getting the most out of optimum because flexibility is one of its chief characteristics. Designed for use in areas where weather reporting will probably never be as complete as it is in the United States, it makes available to the navigator methods of in-flight re-analysis on which to base flight plan amendments.

Inability to make full use of the information gained by re-analysis robs optimum of some of its advantage. Present clearances limit a flight to a 50 mile wide corridor and eliminate any opportunity to "play the weather."

One MATS pilot has suggested that optimum would show a bigger advantage if it were not for the fat fuel reserves often carried by MATS aircraft as a safety margin. He reports that these eliminate incentive to do the work necessary to get the most from optimum. Destination can always be reached easily and the cumulative value of a few hundred pounds of fuel and a few minutes of flight time saved each flight are not always recognized by air crews.

Meteorologists and navigators approve of the more objective and more useful continuous representation in the 4-D analysis. The former method of presenting winds at certain points in space and time required the navigator or a meteorologist to split the differences subjectively to make data applicable to a specific route and altitude. Since 4-D analysis is somewhat more objective than former methods, it produces a better forecast in the hands of inexperienced meteorologists. Subjective methods are acquired only by experience.

Contour Map

The 4-D analysis is a contour map showing the variations in true height of a certain value of barometric pressure or pressure altitude. In the standard atmosphere, values of barometric pressure are assigned a normal height. Therefore a pressure can be identified in terms of its normal height. This is pressure altitude.

The basic term in the analysis is D value, the difference in feet between the pressure altitude at which the analysis is being made and the same value of true altitude at a point on the map.

Essentially, it is the altimeter correction needed to derive true altitude from pressure altitude.

The advantage of using D value rather than millibars, the conventional meteorological unit of pressure, or the true altitude of a given pressure level, is that the numbers are kept small for ease of computation and it is a relative term easily modified by other relative parameters.

If the true altitude of a point is higher than its pressure altitude, then a plus D value is recorded. For instance, if pressure altitude at a point is 10,000 ft. and true altitude is 10,400

Redstone Airlifted

Army's Redstone missile, produced by the Chrysler Corp. near Detroit, is loaded aboard a USAF Douglas C-124 Globemaster for transport to test site at Patrick AFB, Fla. USAF, Army and Chrysler transportation specialists supervise placing of padded missile aboard transport and the lashing down for the trip.

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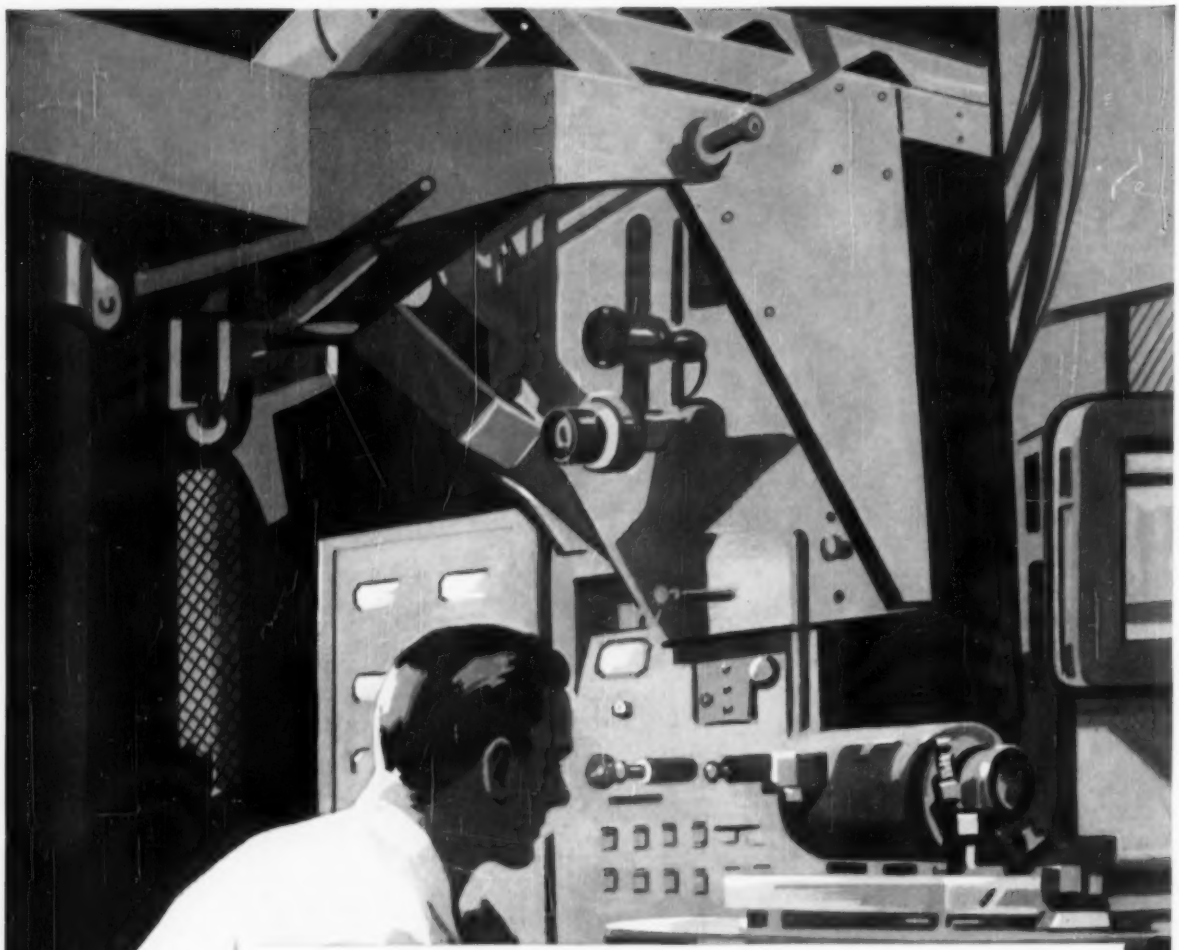

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ft., D value is +400. If true altitude is lower than pressure altitude at a point then a minus D value is recorded. When conditions are standard and uncorrected pressure altitude is the same as true altitude, D is zero.

On the 4-D analysis chart, lines of equal value analogous to contour lines are drawn and each line is separated from the next by an arbitrary difference in D value such as 200 ft. The horizontal distance in miles between the contour lines divided by the vertical difference in D value between them represents the rate at which pressure rises or falls along a horizontal scale at the moment the analysis is made. The steepness of this gradient indicates the intensity of the pressure system.

In the absence of a dense network of stations reporting actual winds, a theoretical approximation is needed to convert pressure distribution to winds. This approximation is found in the geostrophic assumption that winds will flow parallel to the pressure level contour lines and with high pressures to the right and lows to left at a speed inversely proportional to the spacing between the lines.

The driving force behind the wind is the pressure gradient since air tends to flow down the gradient to flatten highs and fill lows. In geostrophic flow, the direction of the wind is not across the contour lines as might be expected, but parallel to them because Coriolis force deflects moving air masses to the right in the northern hemisphere and to the left in the southern hemisphere, opposing the pressure gradient force. When the velocity of the air mass is great enough to generate Coriolis force equal to pressure gradient force, the resultant direction of flow will be parallel to the contour lines.

Known Error

There is a known amount of error in the geostrophic approximation because of the effects of surface friction and centrifugal force in curved flow, but the error is of the same order of magnitude as the probable error in the plotting of the pressure distribution on which the wind calculation is based so it is generally ignored. Inaccuracy of the geostrophic wind as a representation of the actual wind is usually limited to an error in velocity. Direction of flow conforms quite closely to theory.

If pressure systems never shifted or changed and if the flight were made at precisely the pressure altitude of the analysis, the geostrophic approximation and the D analysis would make possible good pressure pattern flight plans. Since they move and change continuously and since flights must often be made at altitudes other than that of the analysis, the 4-D analysis incorporates other gradient type presentations for change of D with time and altitude.

Variation of D with time is designated by the Greek letter Tau. The Tau value is stated as change of D in feet per hour. A rise is recorded as a plus value and a fall is recorded as a minus value. The meteorologist derives it by interpolating between the current analysis and a forecast. If it is a 24 hour forecast, he will measure the variation of D for a number of points in that period and will divide the variation at each point by 24 to arrive at the Tau value for the point. Lines of equal Tau value are then plotted on the 4-D analysis so that the flight planner can interpolate between adjacent lines to find Tau for any point on the map.

The flight planner multiplies the Tau value at a point by the age of the analysis in hours and adds this to the D value on the analysis to get D value at the time of flight. As the flight progresses and the analysis ages, the multiples of Tau used increase at one per hour. Each hour's flight is based on a forecast for the appropriate time.

S Value

The analysis is translated to other altitudes by means of the S value which is the D change in feet per thousand feet of pressure altitude. S stands for Specific Temperature Anomaly and means the variation of temperature at a pressure altitude from the temperature at that altitude in the standard atmosphere. The thickness of a layer of air with a given mean pressure altitude is dependent on its mean temperature, therefore the D value at a pressure altitude surface in the layer can be calculated from the temperature anomaly and the known D value at the analysis altitude.

The tool for figuring S value is a graph known as a Pastagram which gets its name from the initials of Pressure

Moon Radar to Track Satellite

Diana Moon Radar Antenna presently is being used to calibrate Minitrack equipment in preparation for tracking of the earth satellite to be launched in conjunction with the International Geophysical Year. Diana, a development of the Army Signal Engineering Laboratories at Fort Monmouth, also is being used in studies of moon radar reflections.

Altitude vs. Specific Temperature Anomaly. The S value is indicated by the point at which the appropriate temperature line intersects the appropriate altitude line. If the temperature is above standard for that pressure altitude, the sign of the S value is plus, if it is below standard the sign is minus. The S value is multiplied by the number of thousands of feet between analysis altitude and flight altitudes and added to the D value at the analysis level if flight altitude is higher and subtracted if flight altitude is lower.

In MATS Pacific Division, the use of S has been abandoned as it is the only part of the analysis which must remain fixed in time. Division meteorologists feel that an S value several hours old is not often worth plotting, especially since most of the division's flights are within 2,000 ft. of the regular 700 millibar (9,880 ft. pressure altitude) analysis. The D change in this distance is not ordinarily significant. The S value is now most commonly used for in-flight re-analysis. In this case it is based upon observations made independently after the plane is in the air.

An optimum track is laid out on a 4-D analysis chart by constructing hourly time fronts between departure and destination and then plotting hourly headings. The first-time front is constructed by plotting the points which would be reached after an hour's flight on a number of possible headings and drawing a line between them. This is the time front. The shortest distance in miles between the point of departure and any point on the time front is equal to ground speed since the time of flight is one hour. Successive time fronts all the way to the destination are laid out by finding the points reached after an hour's flight on headings perpendicular to the last front and joining them in the new front.

The hourly time fronts could be constructed by figuring a great many point winds by means of the geostrophic formula and then computing a series of wind triangles to get ground speeds with which to plot the points for the construction off each time front. Obviously, the time required for this would be prohibitive.

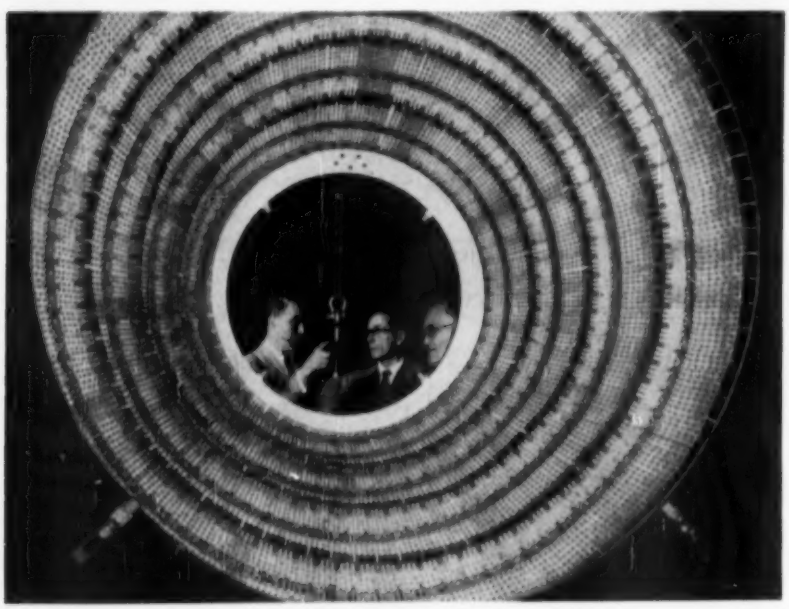
Plastic Computer

Cook Research has created a translucent plastic computer which can be used to do this without estimating winds or drawing vector diagrams. Based upon the perpendicular relationship between pressure gradient and wind directions, it derives tailwind or headwind component from the pressure gradient along a reference line perpendicular to the heading and crosswind component from the gradient along a reference line to the heading. The lines are drawn on the computer in the form of a cross and are the same arbitrary length because the change in D value from one end of a reference line to the other is the basis for calculation of one of the wind components. If D value falls from the right end to the left end of the lateral line, there will be a tailwind and its strength will depend on the amount of the drop. If D falls from left to right there will be a headwind.

If D value falls from rear to front along the heading line, the crosswind component will be from left to right. The reverse will be true if D falls from front to rear.

Since the duration of flight can be found before the track is drawn simply by counting the time fronts, the fuel requirement can be established 15 or 20 minutes before the flight plan is complete. The track is then drawn backward from destination to departure. The heading from the last time front to the destination should be perpendicular to the front to give the minimal track. The computer is then used to figure the drift in miles due to crosswind on that heading in the fraction of an hour required to reach destination. A point is marked on the chart upwind from destination a distance equal to drift. The heading line is drawn between this point and the last front. Where the two intersect is the point of departure from the last front to destination. A line between this point and the destination is the minimal time track. Track heading and drift lines form the familiar wind triangle though no wind values as such are used.

The point of departure from the last time front now becomes the destination in the flight from the preceding time front and the procedure is repeated for each hourly zone all the way back to the original departure point. It will automatically provide the optimum balance between the best wind conditions and extra distance flown to obtain them.



Heater Tests Nose Cones

Nose cone of Army's Redstone missile is tested in this funnel shaped heater made up of banks of more than 1,000 quartz infrared lamps capable of simulating heat of re-entry. Hydraulic jacks simulate stresses of re-entry during heating tests, which last approximately 30 sec. 3,600,000 watts of electricity are required for a test. Heater is at Chrysler plant near Detroit where Redstone is manufactured.

WHAT'S NEW

Reports Available:

The following reports were sponsored by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.:

The Preparation and Properties of Some Fluorine-Containing Diesters—by J. F. O'Brien and others, Wright Air Development Center. $1.00; 39pp. (P.B. 121910). Nonmetallic Ferromagnetic Materials—by General Electric Company for Wright Air Development Center.

Part 1—Thin Films: $.50, 18pp.: (P.B. 121861).

Part 2—Low-Loss, High-Temperature Ferrites: $.75, 27pp.: (P.B. 121874).

Part 3—Ferrite Single Crystals: $.75, 23pp.: (P.B. 121858).

Part 4—The NiO-Fe_2O_3 System:

$.75, 28pp.: (P.B. 121869).
Part 5–Ferrite Delay Lines: $2.50, 95pp.: (P.B. 121868).

Crack Propagation in the Hydrogen-Induced Brittle Fracture of Steel–by W. J. Barnett and A. R. Troiano, Case Institute of Technology for Wright Air Development Center: $1.50, 58pp. (P.B. 121065).

The Relation of Heat Treatment to the Dynamic Properties of Some Carbon Steels–by R. C. Smith, Naval Research Laboratory: $.50; 16pp. (P.B. 121514).

A Program of Human Engineering Research on the Design of Aircraft Instrument Displays and Controls–by A. C. Williams, Jr. and M. Adelson, Hughes Aircraft Co. and M. L. Ritchie, University of Illinois, for Wright Air Development Center. $1.00; 39pp. (P.B. 121896).

Effect of Gloves on Control Operation Time–by J. V. Bradley, Wright Air Development Center: $.50; 16pp. (P.B. 121929).

The Ability of Untrained Observers to Match Visual Forms that are Slightly Disparate in Contour–by J. Deese, the John Hopkins University for Wright Air Development Center: $.50; 18pp. (P. B. 121820).

Procedures for Including Human Engineering Factors in the Development of Weapons Systems–by H. P. Van Cott and J. W. Altman, American Institute for Research for Wright Air Development Center: $3.00; 119pp. (P.B. 121916).

Reliability Design Handbook–by the Navy Electronics Laboratory: $3.00; (P.B. 121839).

Symposium on Preservation for Mobilization Requirements–by U. S. Naval Civil Engineering Research and Evaluation Laboratory: $8.00; 524pp. (P.B. 131007).

Electron Transport Properties of Dilute Binary Magnesium Alloys–by E. W. Kammer, Naval Research Laboratory. $.50; 19pp. (P.B. 121581).

A Direct Measurement Technique of Determining Rocket Exhaust Velocities. –by L. E. Bollinger and R. Edse, the Ohio State University Research Foundation on for Wright Air Development Center. $1.00; 40pp. (P.B. 121871).

Cumulative Fatigue Damage of Aircraft Structural Materials. Part 2: 2024 and 7075 Aluminum Alloy Additional Data and Evaluation: A. M. Freudenthal and R. A. Heller, Columbia University for Wright Air Development Center: $.75; 27pp. (P.B. 121909).

The Properties of Constructional Metals as a Function of Temperature and Strain Rate in Torsion–by E. P. Klier and others, Syracuse University for Wright Air Development Center: $4.00; 201pp. (P.B. 121912).

Chlorosulfonation of Silanes and Related Reactions–by C. G. Overberger and F. M. Beringer, Polytechnic Institute of Brooklyn for Wright Air Development Center: $1.00; 37pp. (P.B. 121973).

Development of a Micro Method for the Determination of Aliphatic Aldehydes–by E. W. Malmberg and B. Weinstein, the Ohio State University Research Foundation for the Wright Air Development Center: $1.00; 33pp. (P.B. 121996).

The Cryoscopic Heat of Fusion of Ammonium Nitrate–by A. G. Kennan, Illinois Institute of Technology for Air Force Office of Scientific Research: $.50; 14pp. (P.B. 121552).

Survey of Fundamental Knowledge of Mechanisms of Action of Flame-Extinguishing Agents–by R. Friedman and J. B. Levy, Atlantic Research Laboratory for Wright Air Development Center: $2.50; 100pp. (P.B. 121853).

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Air Force Research Material from July 1, 1954 to June 30, 1955: $3.50 (P.B. 111648-s).

Air Force Research Material from July 1, 1953 to June 30, 1955: $2.75 (P.B. 111648).

Vapor Deposited Coating. Final Report:–by L. M. Schetky, H. S. Spacil, and J. W. Wulff, Massachusetts Institute of Technology for Watertown Arsenal, U. S. Army: $1.75; 64pp. (P.B. 121725).

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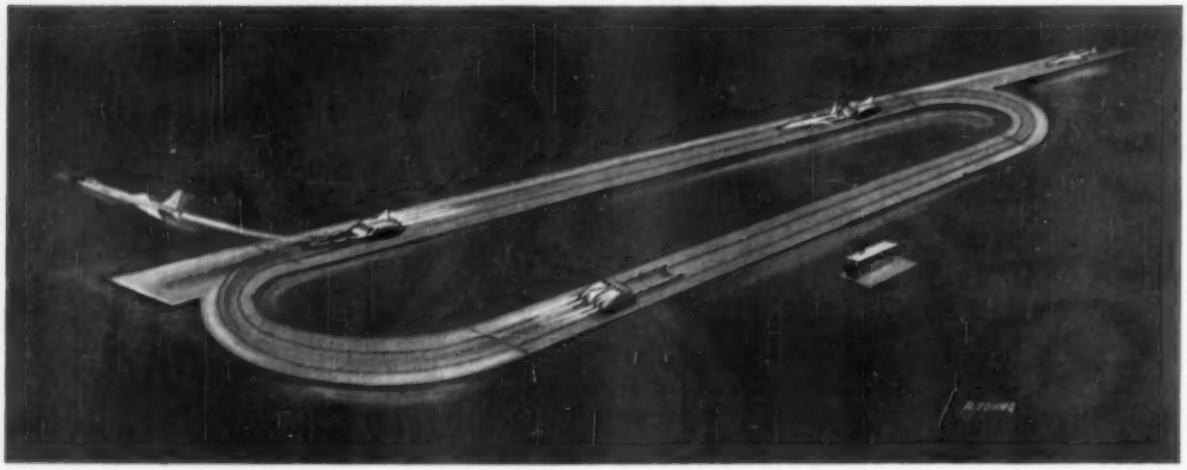


ARTIST'S concept of Short Field Installation shows how relay of jet cars could launch a plane (left) and return for additional aircraft. Speed of unmanned cars is remotely controlled from the small shack in the foreground.

Carrier Deck Gear Development Pushed

By George L. Christian

Lakehurst, N. J.—Future of carrier-based aviation hinges on pushing development of launching and recovery systems steadily ahead of development of the growing stable of high performance aircraft being designed, built and qualified for fleet operation.

This premise, which already has resulted in development of an internal combustion catapult not dependent on a nuclear carrier's reactor, is spurring the Navy into investing $35¼-million in a new launching and recovery system test facility here. To date, almost $22-million is already under contract.

Called Naval Air Test Facility (Ship Installations), the center is being bulldozed out of a 4,500 acre scrub pine site at the Lakehurst Naval Air Station, known historically as the Navy's lighter-than-air headquarters.

Reason for building such comprehensive facilities for NATF is to assure that, as new, increasingly fast and heavy planes move out into the fleet, carriers' catapults and arresting gear will be capable of handling them. If catapults or arresting gear are inadequate or become inoperative, then $200-million ships as the Forrestal, Saratoga, Ranger and the proposed atom-powered CVAN (Carrier Attack, Nuclear) become mere floating hangars because of their inability to make their jet plane striking force operational.

NATF's Dual Mission

Cmdr. R. M. Tunnell, BuAer Project Officer of the facility, told AVIATION WEEK that the mission of NATF is to evaluate aircraft launching and recovery equipment and related components. It will take all such gear and test and evaluate it to determine whether it is suitable for a given class of carrier before the equipment is committed to a ship. A catapult is such an integral part of a carrier that it becomes a major operation to remove it should it be unsuitable.

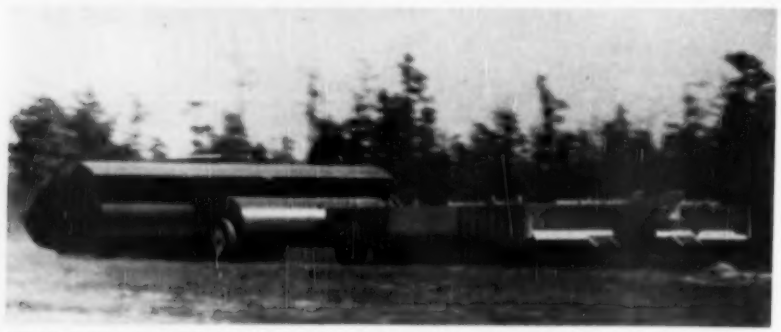
"Second part of our mission is to support the development of launching and recovery systems by providing facilities and services to contractors and government agencies engaged in development programs in this field," he said. "Contractors will find here a facility where they can conduct, with their own people if they desire, large scale and diversified tests on their equipment."

Some of the more important problems the facility will tackle:

• **Launching.** Feasibility of higher launching and recovery speeds to give airframe designers a freer hand in developing very high performance aircraft will be investigated. Faster take off and landing speeds will impose greater G forces on pilot, plane and equipment and the Navy wants to find what the practical limits of these forces are. Current catapults impose a peak of about 5Gs on the pilot during the two second launch; arresting loads are about 3-3½Gs.

If it is found that higher launching Gs will momentarily black out pilots, a requirement may be created for a device which will automatically take the plane off from the carrier and control it for several seconds of initial flight to allow the pilot to recover sufficiently to handle the controls.

Another problem is that the reactor of the Navy's proposed nuclear-powered carrier will not develop the approximate 800 psi. of steam pressure required for catapult operation. Therefore, a program is under way to develop catapult powering systems independent of the



JET CAR, powered by four J33 turbojets, pushes dead load of 50,000 lb. to speed of 175 kt. for testing strength of recovery gear. Car (rear) stops and load coasts into gear.

reactor. Reaction Motors, Inc., has designed an air/gas generator, prototype of which is being tested at the Naval Air Rocket Test Station, Lake Denmark, N. J. (AW Aug. 12, p. 23) and is called Internal Combustion Catapult Powerplant (AW May 6, p. 38). Second ICCP, now under construction, incorporates several improvements resulting from tests at the rocket station. It will undergo a two year development and evaluation test program at NATF.

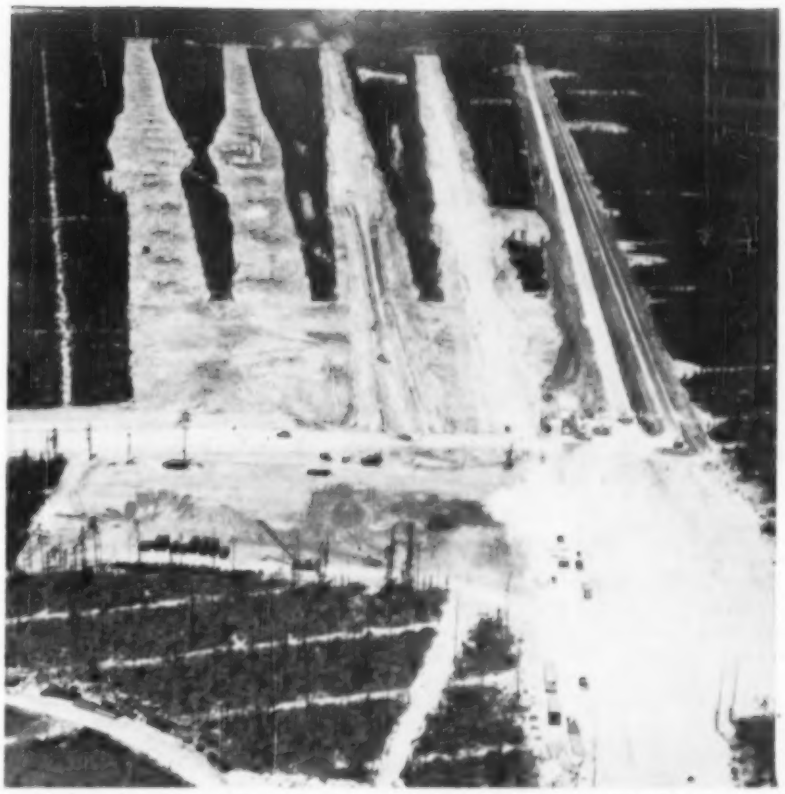
• **Recovery.** If higher launching speeds become practical, then recovery systems capable of handling higher landing speeds must be developed simultaneously.

Vibration Problem

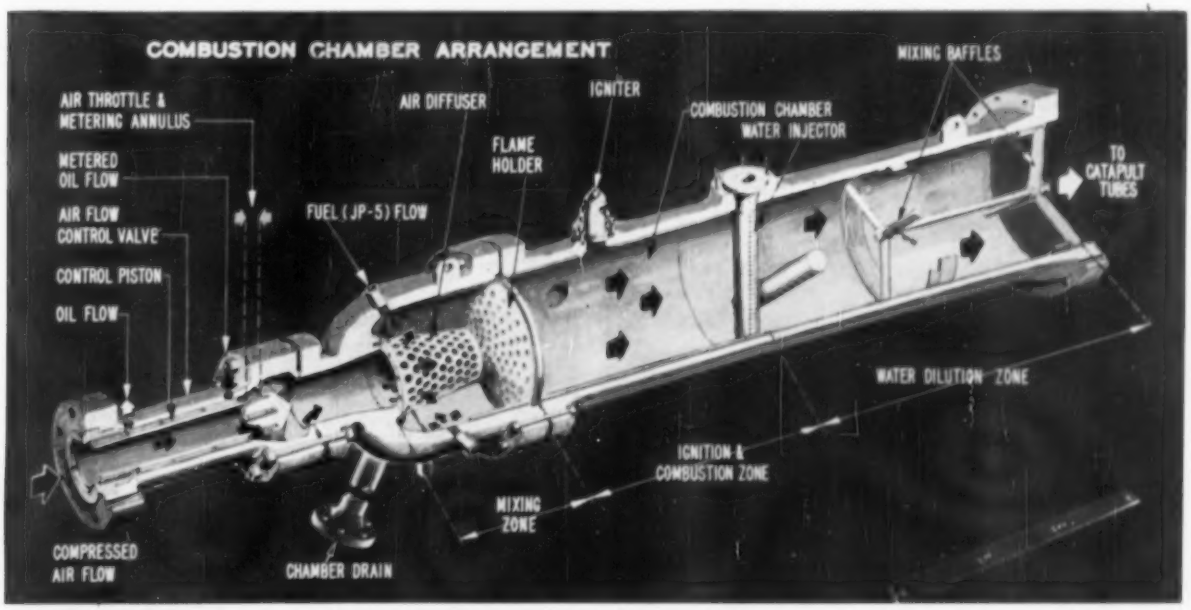
An associated problem relates to vibratory loads, induced in cables by arresting hooks of heavy and high speed planes, which spread through the wire into both the arresting engine and the airframe, may damage either or both. These vibratory stresses may also snap the cable itself, causing a hazard. The overall vibration problem is spurring a priority Navy research program into vibration dampers to alleviate the difficulty.

Of the facilities which the Navy will provide when the facility is in full swing, possibly by 1960, some are already completed and a majority are under construction. The rest are in the planning stage only.

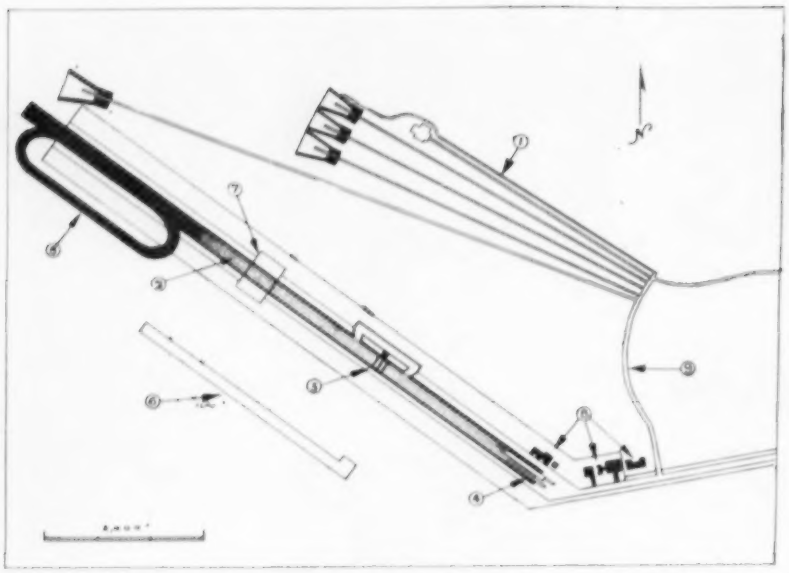
Recovery System Test Site consists of five jet car tracks. On these tracks, jet



FIVE TRACKS are planned at Recovery System Test Site and one (right) already is in operation. It is 5,800 ft. long. Of the four other tracks under construction, three will be 7,300 ft. long and the last will be 12,600 ft. long and capable of test speeds up to 250 kt. It is last track on left. Jet cars will be used on tracks to push deadloads or uninhabited aircraft into arresting gear systems.



REACTION MOTOR'S Internal Combustion Catapult Powerplant is shown in this drawing for the first time. Compressed air enters at left, is mixed with JP-5 fuel in mixing chamber and ignited. Water, sprayed into the machine through injector, is flashed into steam by heat of burning JP-5, expands rapidly and is directed to catapult tubes through opening at right. Device was required to power C14 catapult being planned for Navy's CVAN (nuclear-powered carrier) because steam pressure generated by reactors is well below the 800 psi. needed by steam catapults (AW Aug. 12, p. 23).



LAYOUT of Naval Air Test Facility (Ship Installations) at Lakehurst NAS. Facility includes: (1) Recovery System Test Site with five jet car tracks; (2) 8,000 ft. runway with 4,000 ft. extension at upper left; (3) Runway Arrested Landing Site; (4) C13 and C14 catapult installations; (5) Short Field Installation with return track; (6) High-G test facility; (7) Expeditionary (portable) arresting gear test site; (8) Powerhouse, Special Projects and Engineering buildings; (9) Aircraft tow-way.

cars powered by old-model aircraft jet engines will push deadloads of aircraft weight at high speeds. At a predetermined point, the engines are shut down and the car quickly will be braked to a stop. The deadload hurtles into an arresting cable at a velocity equivalent to a plane's landing speed to test the recovery system. Dual center-mounted steel rails guide car and deadload down concrete runways.

First track, 5,800 ft. long, is in operation. Car used is powered by four J33 turbojets and pushes a deadload made of sturdy steel I-beams mounted on four pneumatic-tired wheels. Weight is 23,000 lb. empty, 50,000 lb. fully weighted.

Car was designed and built for the job by All American Engineering Company which has completed a second J33-powered car, very similar to the first. Certain cowling modifications made on the new car make its components more accessible, increasing its maintainability. Company is also currently responsible for operation of the track at NATF which has a capability of 175 kt. with the 50,000 lb. deadload.

Other four tracks are under construction. Three will be 7,300 ft. long and will have 200 kt. capabilities with 50,000 lb. deadloads. Last track will be 12,600 ft. long and will have a 250 kt. capability with the same 50,000 lb. deadload.

Recovery System Test Site will be used exclusively to test arresting gear systems. Jet cars will also be used to push captive, uninhabited aircraft into the recovery systems to evaluate their compatibility with actual airframes under circumstances which cannot be duplicated with deadloads.

Test site for catapult systems is being built at the southeast end of an already-completed 8,000 ft. runway. A 4,000 ft. extension to the northwest is being proposed.

Reason for building a new runway independent of existing landing facilities at Lakehurst was that runway lengths might not be adequate to handle some of the newer planes. Also, the Navy did not want to clutter up a busy, operational air field with catapults and arresting gear.

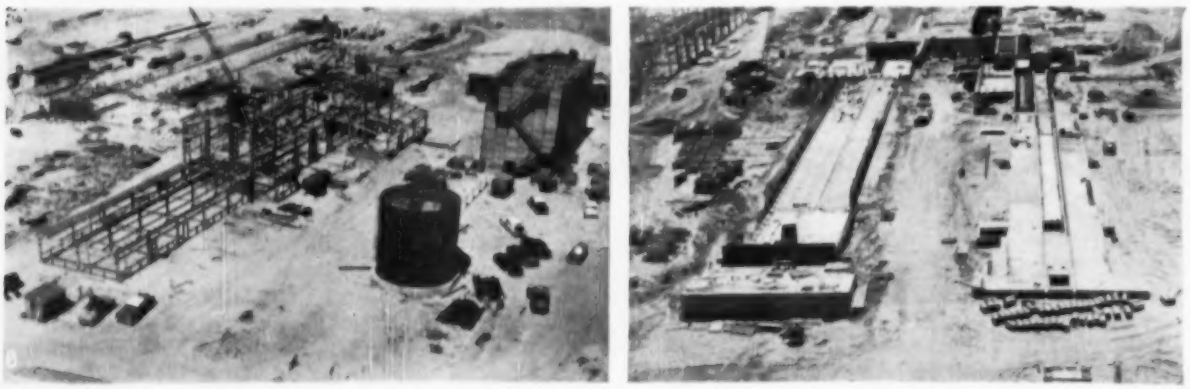
Catapults are put at the end of the runway rather than on the recovery system test site so that, if one fails, the other still can be used.

Currently under construction at the runway are installations for two catapults. One is a standard, steam-operated C13 unit being built by the E. W. Bliss Company. Feature of the C13 catapult facility is that the entire length of the catapult—about 250 ft.—is elevated six feet above runway level. A fixed ramp leading to the catapult allows planes to taxi or to be towed into place. A movable ramp at the launching end of the installation, when in place, allows a plane to roll down to runway level again. If removed, however, it opens a six foot drop at the firing end of the catapult to simulate the drop-off from a carrier's bow. This will allow planes that have a tendency to sink somewhat after launching to duplicate this tendency on the C13 catapult facility—up to a distance of six feet.

C14 Catapult

Alongside the C13 is a C14 catapult. Both converge slightly on the midpoint of the runway 4,000 ft. away.

C14 catapult is also being built by Bliss, but the engine powering it will be RMI's second Internal Combustion Catapult powerplant. To generate the energy needed to launch a heavy jet, the powerplant creates its own steam



POWERHOUSE framework is shown (left). Aerial photo (right) shows C13 steam catapult (left) and C14 air/gas catapult construction progress. Note how C13 installation is raised 6 ft. above runway.

in large quantities without recourse to a carrier's boilers or nuclear reactor.

The relatively small machine is cylindrical, measures about 13 ft. in length and has an overall diameter of approximately 2½ ft. To produce power for the catapult, air compressed to a maximum pressure of 1,500 psi. is introduced at the small end of the powerplant. Air is directed to a mixing zone through a perforated air diffuser. JP-5 fuel is injected into the mixing zone through several nozzles located circumferentially around the powerplant. JP-5 fuel is used to simplify logistics since it is aboard the carrier for the jet planes.

Catapult Operation

The fuel/air mixture passes from the mixing zone to the ignition and combustion zone through a flame holder and is ignited by an electric spark. The very hot flame impinges on a water injector in the center of the circular chamber. Water sprayed through perforations in the injector is instantly flashed to steam by the intense heat. Steam passes through the water dilution zone, which contains two sets of mixing baffles, then is directed to the catapult tubes.

Steam performs the dual jobs of greatly increasing the mass of the propellant and also cooling it before it enters the catapult tubes to drive the piston down the cylinder.

A major difference between the C13's and C14's operation is that the latter generates power as it is needed instead of drawing on power (steam) stored in large accumulators. Problem facing the C14 is to generate power evenly to provide a constant rate of acceleration to the plane being launched to keep G forces at a minimum.

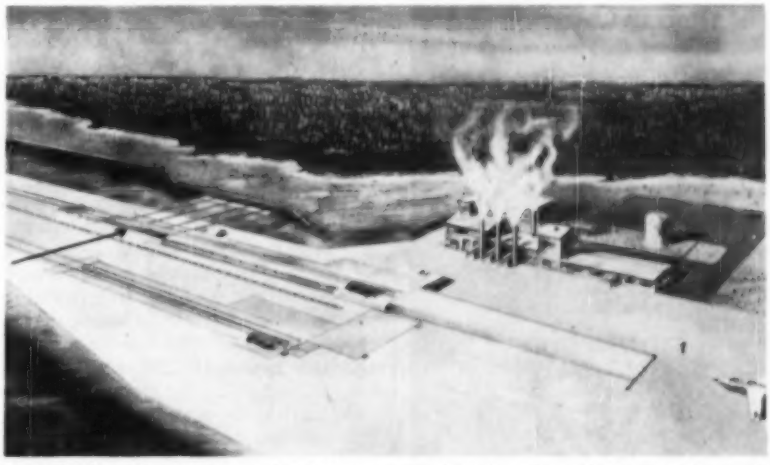
Extending 400 ft. from the firing end of each catapult are tracks submerged below the surface of the runway. These will be used with friction-type brakes to stop deadloads fired by the catapults during tests. A family of deadloads will be available with weights ranging from 10,000 to 100,000 pounds.

Catapults will be used to propel either deadloads or planes, depending on tests being conducted.

At the 4,000 ft. mid-point of the runway, construction is under way on a Runway Arrested Landing Site (RALS) which will be used to test and evaluate arresting gear systems, including engines, and barricades. Barricades are emergency devices—usually some arrangement of nylon webbing—used as a backstop to halt a plane in case it fails to engage the arresting gear. They are not the same as the cable barrier formerly used on carriers.

RALS includes a large subterranean room capable of accommodating six arresting engines of the Mark 7 type and

RECOVERY System Test Site. Artist's drawing shows jet car stopped (center) as deadload hurtles into arresting pendant (right). Arresting engine is in shack (foreground). Technicians in trailer are protected from whipping of broken cable by earth revetment.



FACILITIES at Southeast end of 8,000 ft. runway include, left to right: C14 air-gas catapult flush with runway; C13 steam catapult raised six feet above runway (note removable ramp indicated by arrow); and powerhouse on which is mounted a control tower.

RUNWAY Arrested Landing Site drawing shows under-runway installation of four Mk. 7 Mod. 1 arresting engines with space for two more. At right is diversion strip for rapid-landing operation and RALS control station. Mirror landing system is shown at left.

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size. A Mk. 7 type arresting engine is no toy—it is approximately 6 ft. wide, 7 ft. high, 50 ft. long, weighs 60,000 lb. and costs about $150,000. A complement of six is usually installed on a carrier.

Four Mk. 7 Mod. 1 arresting engines, the model currently being used aboard operational carriers, are being installed at RALS. Two additional engines will be added when needed.

RALS is needed on several counts:

• **Landings** in quick succession—carriers sometimes take planes aboard in 20 second intervals—can be duplicated by RALS by moving a plane on to a diversion strip to the right of the runway immediately after it has been disengaged from the arresting gear to allow succeeding planes to land. It is this quick succession of landings that puts the severest strain on arresting cables—the part strung across the deck is called the pendant—and the engine. This is particularly true if several successive planes engage the same wire instead of distributing engagements over the wires available.

Rapid succession landings cannot be duplicated on the jet car recovery tracks because it is impossible to fire the deadloads and return them to the opposite end of the track fast enough to simulate 20 second interval landings.

• **Arresting gear** systems must be evaluated with actual aircraft to give realistic performance data and to insure they are sound pieces of operational equipment. Reason is that the arresting gear acts as a spring while the aircraft is an elastic mass with a structure that has a certain amount of give, and is equipped with landing gear struts that partially collapse upon landing. Deadloads made of heavy steel I-beams welded together and riding on unsprung wheels are rigid masses which give different reactions to an arresting gear's operation.

RALS was purposely spotted halfway down the runway so that planes could land into it from either direction, depending on wind conditions, and still have 4,000 ft. left for a go-around if necessary. When the additional 4,000 ft. are built on to the runway, there will be 8,000 ft. available northwest of the RALS.

Big Powerhouse

A large powerhouse is being erected adjacent to the southeast end of the runway to supply power to the steam and air/gasoline catapults.

Steam for the C13 catapult will be supplied by four high pressure boilers which will produce 36,000 lb./hr. of steam at 1,200 psi. Their combined outputs will be used to operate the catapult.

Fifth boiler will supply low pressure, utility steam.

A compressor plant within the powerhouse will supply compressed air to the C14 catapult.

Two large steam turbines of 7,500 hp. each will drive a three-stage air compressor to provide the quantity of air required by the C14's Internal Combustion Catapult powerplant. Turbines are being supplied by Westinghouse, compressor by Carrier under sub-contract to Reaction Motors.

On top of the powerhouse will be a small control tower which will be used primarily to control action at the catapult and RALS sites. Aircraft flying into or out of NATF's runway will be controlled by the regular Lakehurst tower, at least for the time being. A problem exists because of the great distance between the Lakehurst tower and the new landing strip.

An instrumentation shop and photo lab will also be included in the powerhouse.

Special Projects

A Special Projects Building is being erected on the taxiway leading to the landing strip and catapults. It will house NATF engineering and administrative personnel and will have hangar space. Latter will be used to prepare aircraft for test, install instrumentation, external stores and the like. Building will also house a machine shop which will be used to modify test equipment and provide facilities for an experimental and job shop.

Ground facilities at NATF include: taxiway between Lakehurst NAS's airfield and the 8,000 ft. runway which has been completed. It permits planes to land at the base's airfield and taxi to the catapults in case the NATF runway is tied up with experimental work.

A taxiway joining the southeast end of the runway with the Recovery System Test Site is nearing completion.

An access road has been built between the Naval Air Station and the Recovery System Test Site and extended to parallel the first track which is now in operation.

Most of these projects have been funded under appropriations totalling $21,726,700.

Several additional facilities, as yet

British Exchange Program

U. S. Navy spokesmen have high praise for the many "developments of Britain's Royal Navy and the exchange program which has allowed this country to develop them to the current state of the art."

Among the British concepts which have been instrumental in improving the operational efficiency and safety of high performance aircraft flying from carriers are: angled deck, steam catapult, and mirror landing system.

unfunded and totalling $13,769,000, are being planned for NATF.

Most important single item is the High-G facility, which alone is budgeted at $9.8-million.

A 7,000 ft. runway parallel to but South of the 8,000 ft. runway will be the site of the proposed facility. Its purpose, Cmdr. Tunnell said, is to explore the limits of forces which can be imposed on human beings and equipment during catapult launchings and arrested landings.

Carrier's flight deck length has been increasing only a little compared with airplane performance, so there is a growing need to push planes harder to get them airborne safely.

Launchings with current catapults take about two seconds during which pilots are subjected to a maximum of about 5 Gs.

If pilot, plane and its equipment could withstand doubling these forces, airframe makers would have considerably greater leeway in designing high performance into their carrier-based aircraft.

Purpose for having a 7,000 ft. long runway is that the Navy wants to be able to catapult a pilot at speeds up to 200 kt. and keep him under observation for 15 seconds to see whether he is capable of flying an airplane after having been subjected to a given number of Gs. To accomplish this, a sled propelled by jet engines will be used. Jet engines will supply sustained thrust after the initial catapulting.

If accelerations impair the pilot's ability to fly the plane immediately after launching, the Navy may be compelled to develop some means of controlling a plane's first few moments of flight completely automatically to give the pilot sufficient time to recover before taking over the controls (AW Aug. 19, p. 23).

Additional Facilities

An additional facility planned is a 4,000 ft. extension at the northwest end of the runway which will be used specifically to test the feasibility of short field installations.

If 4,000 ft. runways can be built to handle high performance jets successfully instead of the 12,000-14,000 ft. runways now required, much money and time could be saved.

The Short Field Installation will be used as a development program to test various methods of making such a concept work. Jet cars will be used to "tow aircraft from behind" to help them accelerate to flying speed in the runway's 4,000 ft. Navy believes that jet cars, using obsolete surplus engines, are a cheap and effective way to give high performance planes the extra boost they need to take off in short distances. Jet cars, being behind the aircraft, will have

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to be designed to avoid or deflect the engine's jet blast as the plane gathers speed during its take off run.

A race track-like loop built beside the runway will allow the jet cars to swing around time after time to pick up as many aircraft as needed. Also, two or more jet cars may operate simultaneously, with some returning while others are launching if short interval take offs are required. Jet cars will be guided by tracks and controlled remotely from center of loop.

Portable Gear

An Expeditionary (portable) Arresting Gear Site is being planned for the far end of the 8,000 ft. runway to evaluate various expeditionary arresting gear designs to determine the most practical configurations.

An engineering building to supplement the special projects building is being proposed to take care of anticipated expansion of engineering requirements at NATF.

Cmdr. Tunnell listed the planes and powerplants he needs as minimum requirements to cover the weight and take off and landing speed spectrum of current ship-borne aircraft. He emphasized that this is but an initial list and is of necessity very flexible; it can and will change as time passes. The list is:

- **Douglas AD-6** (R3350).
- **Grumman TF-1** or S2F-2 (R1820).
- **Grumman F9F-8** (J48).
- **McDonnell F3H-2N** (J71).
- **North American AJ-2** (two R2800s, one J33).
- **Douglas A3D** (two J57s).
- **Douglas A4D** (J65).

Recovery system test site facilities are currently being operated by All American Engineering personnel. Technicians during a test sit in a trailer protected by a thick earth revetment. Precautions are taken in case the arresting cable should snap and whip around the recovery area.

Deadload Test

After the usual count-down, a cloud of dust at the starting end of the track shows that the car's four jet engines are running. Initial acceleration pushing the 23,000 lb. deadload is slow. Gradually, the car/deadload gathers speed and comes whining down the concrete. Near the end of the runway the jet engines are automatically shut down and the jet car is braked to a smooth stop by spring-loaded friction plates clutching the guiding I-beams in the center of the track. The deadload hurtles past at over 100 kt. pitching noticeably on its four pneumatic tires. Hook at the back of the deadload engages the single arresting wire streched about three feet above the track. The 23,000 lb. vehicle silently slows to a stop in less than 200 ft. by the Mk. 7 Mod. 2 arresting engine located in a metal shack at the right of the track.

The Mk. 7 Mod. 2 engine, which the Navy is testing at NATF, can dissipate about 30-million ft./lb. of energy. The Mk. 7 Mod. 1 units, now in service with the fleet, dissipates 24-million ft./lb. of energy.

This is how the arresting cable and engine are set up. The pendant is stretched across the deck and is attached to the purchase cable which runs through sheaves to the arresting engine and is reeved several times around it.

When a plane engages the pendant, it pulls out the purchase cable which drives a large hydraulic piston into a cylinder in the arresting engine to absorb the plane's kinetic energy. A new constant run-out control in the engine keeps the plane's deceleration at a constant rate to reduce arresting loads imposed on pilot and plane to a minimum.

Problem of cable vibration and possible breakage was described by a NATF technician. "When the arresting hook of an airplane engages the cross deck pendant," he said, "a small V-shaped kink is formed. This V kink gets progressively larger as the motion, called traverse wave, travels to the deck sheaves at a speed dependent on the aircraft's engaging velocity. Traverse wave speed may reach 750-1,000 ft./sec.

Stress Wave

"At the same time, the engaging hook creates a longitudinal stress wave in the cable itself which travels to the arresting engine at a speed of approximately 10,000 ft./sec. Because of its high speed, the longitudinal stress wave travels to the arresting engine and returns towards the hook so quickly that it may overtake the slower traverse wave."

"If the two cable stresses should happen to collide at the deck sheaves, very high peak tensions are created in the cable which may cause it to rupture. Loads are also retransmitted to the aircraft and arresting engine with adverse effects."

To overcome such failures, Navy scientists are developing various types of vibration dampers under a high urgency program. Designs tried so far with moderate success include typical hydraulic snubbing devices and semi-rigid dampers using undrawn nylon. The snubbers are installed at the deck-edge sheaves.

Cmdr. Tunnell said that NATF will, of necessity, incorporate a big instrumentation plant. He wants to go to magnetic tape instead of oscillographs because of the former's much greater flexibility and speed. But cost dictates use of oscillographs initially for an interim period. Final period magnetic tape installation, planned for Fiscal 1959, will cost $1½-million or more.

A complement of four officers and six civilians is now working on NATF under Cmdr. Tunnell. Personnel and budget plan call for an expenditure of $630,000 in Fiscal 1958. By the end of Fiscal 1958, nine months from now, personnel should expand to 200; by the end of Fiscal 1959, personnel should increase to 350 and budget to over $2-million.

Ground-breaking at NATF took place in February, 1956. Official commissioning of the facility has been requested for October 1 of this year.

Spokesmen estimate that the 8,000 ft. runway and C13 and C14 catapults will be in operation by the summer of 1958 and the four new tracks at the Recovery System Test Site will begin functioning in the fall of that year.

Organizationally, NATF falls under the military and coordination control of Naval Air Development and Materiel Center, Johnsville, Pa. Management and technical control is exercised by BuAer.

The new unit will be independent of Naval Air Materiel Center, even though both will be working on aspects of the arresting gear and catapult program.

Logistic support, crash and fire protection, overhaul and repair, fiscal details, maintenance of buildings, industrial relations, and medical facilities will be provided by the Lakehurst Naval Air Station.

OFF THE LINE

Carmody Corp. received a production order from the Navy for the design and manufacture of an F9F-8T procedure trainer. Basis of the trainer will be government furnished F9F-5 Operational Flight Trainer simulator cockpits which will be converted to the F9F-8T procedure trainer. This is probably the first time that an obsolete simulator has been given new utility as a procedure trainer, resulting in substantial money savings. . . . Carmody has acquired 11 acres of land near the Buffalo, N. Y. Municipal Airport and hopes to move into its new 15,000 sq. ft. plant being erected there before the end of the year.

Resistoflex Corp. has named Eastman Atlantic Manufacturing Co. of Atlanta, Ga., warehousing distributor for the states of Alabama, Georgia and Florida. Eastman Atlantic will handle such Resistoflex products as Fluoroflex-T Teflon hose, pipe, bellows and accessory components.

Rubber de-icing mat from propeller and wing leading edges, antenna masts or air intakes has been put on the market by the French firm Kleber-Colom-

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VN 710
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SUNDSTRAND DRIVES

provide high-capacity electrical system for Canadair's Argus

Canadair's CL-28 Argus requires a 400-cps electrical system capable of supplying the energy for the most comprehensive collection of electronic detection equipment ever assembled into one aircraft for hunting enemy submarines. In addition, this system must supply the more normal requirements of a very large aircraft designed for maximum duration of flight. Sundstrand Constant Speed Drives meet these requirements providing the Argus with an automatically paralleled 400-cps system of 160-kva capacity. It's a high-capacity, stable electrical system that is efficient, versatile, reliable under all conditions.

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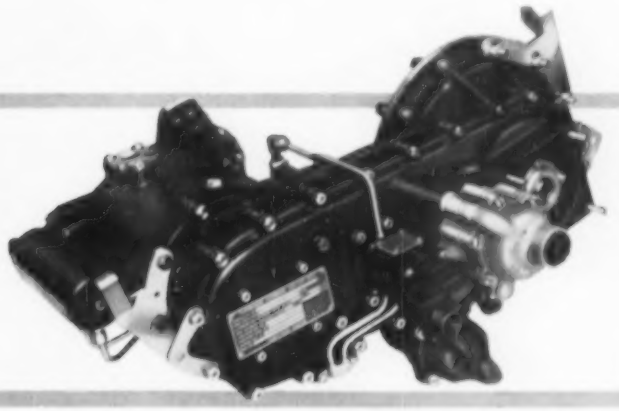
Cartridge-type drive with gearbox, custom-designed for the Argus by Sundstrand, is installed in the nacelle and driven by a shaft from the engine. Four drives are installed in each aircraft, each powering a 40-kva alternator and a hydraulic pump. To date more than 20 different models of Sundstrand Drives have been installed in virtually every major type of aircraft.



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DETAIL of Soviet high altitude head gear.

Pressure Suits for Soviet Pilots Have Similarities to U.S.

Details of late-model Russian high altitude pressure suits are evident in these first pictures to reach the U.S. Soviet garments show similarities to American suits (upper left). Suit worn by man kneeling has very many points in common with a USAF design; it is possibly a Russian copy or even a captured Air Force suit. Other two suits are obviously full-pressure garments with some resemblances to the Goodrich suit (AW July 1, cover).

Note seals at wrists where gloves lock on. Umbilical cord on right chest of full pressure suits is emergency disconnect, containing electrical connections for head set, mike, etc., and probably, but not positively, the oxygen supply.

Round shiny object above the left knee may be pressure sensing device to inflate suit automatically in an emergency.

Close-up of Soviet pilot (above) shows detail on hinge of helmet and of what appears to be a latch just below the oxygen tube. The flexible rim around rear "window" of the helmet looks as if it could be partly for padding to protect the back of the pilot's head.

Picture of pilot descending ladder from cockpit (right) shows that oxygen mask is worn under his helmet, but fishbowl would probably still be pressurized.

Close-up of pilot in cockpit (lower left) showing him in leather helmet,

PILOT descending ladder from cockpit carries object in left hand which is probably a cloth or leather helmet. It is not the crash type to protect his head inside fishbowl. Boots appear to be large and awkward in comparison to Goodrich-developed boots.

bes. Called Altitherm, the mats are heated by electric resistance wires buried in the rubber. Mats can be formed to almost any contour.

A new, lightweight, expendable pallet made of wood and corrugated paper is being produced by Bulldog Pallet Co., Newark, Calif. Unit measures 40 x 48 in., can handle loads up to 4,000 lb. and costs less than $1. Weight is 14 lb. compared to 35 lb. for a wooden pallet of the same size.

Mechanical Division, General Mills, Inc., doubled its research and development programs during its last fiscal year which ended May 31. Its products and services, which included aircraft and missile devices and systems, automatic controls and plastic stratoballoons, were sold chiefly under government contract. During the same period, company's total sales were $527,702,000, $11.6-million above last year's sales figure.

Royalty-paying licensing agreements have been arranged between two of the country's large aircraft hose fitting and assembly manufacturers. Under the agreements, Aeroquip Corporation of Jackson, Mich. long-time advocates of detachable, reusable hose fittings, has been granted rights to produce and sell a new, permanently-attached type of fitting incorporating certain patents and patent applications held by The Weatherhead Co. of Cleveland, Ohio. The fitting features a patented hose-gripping principle and is used with Teflon hose. Simultaneously, Weatherhead received rights to produce and sell Aeroquip's "Super Gem" reusable fittings for Teflon hose which incorporate a lip-seal principle. Both licensing agreements cover the United States and Canada. Result will be a dual source of supply of both permanently attached and detachable fittings.

Design and development contract valued at $246,000 for an electronic printing rectifier has been received by Fairchild Graphic Equipment, Inc. from Rome Air Development Center, Griffiss AFB, N. Y. Machine will accept oblique aerial photographs from which it will reproduce rectified images. It can scan the original negative at 500 lines per inch at a speed of 500 lines per minute and can incorporate enlargement or reduction.

William Brand & Company, Inc. of Willimantic, Conn. has appointed as exclusive sales representatives for their Turbo Multiconductor Cable the Los Angeles firm of Cable & System Engineers, Inc. 11168 Santa Monica Blvd. Multiconductor cables are used in various computer, data processing, missile and television applications.

THREE Soviet pilots donning pressure suits which are similar to comparable U. S. suits

WHAT is probably early model high altitude gear includes leather helmet, oxygen mask.

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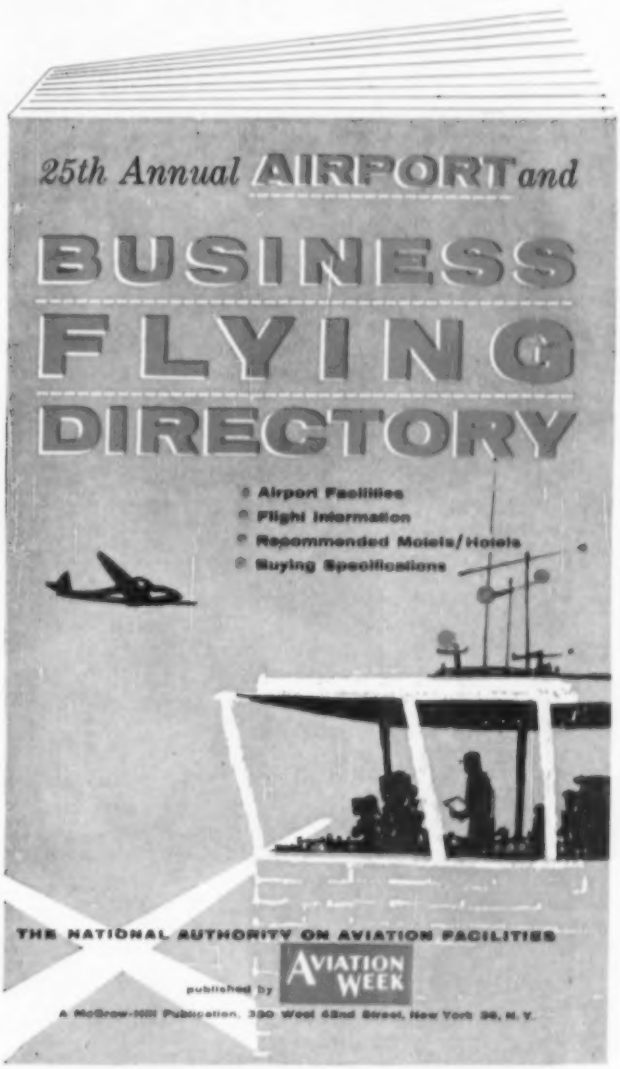

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AW1

SOVIET high altitude helmet is similar to USAF type MB-5.

oxygen mask and large glass helmet with round face plate, is probably an earlier step in pressure suit development.

U.S. experiments several years ago with fishbowl type of helmet, in which helmet stays still and pilot's head moves freely inside, pointed up these objections:

- **Size kept** pilot from being able to get his head close to sides of the cockpit and he could not rise in his seat to get required field of vision to fly an aircraft safely.
- **Acoustics were** bad because of the helmet's shape.
- **Vision was** somewhat distorted.
- **Fogging was** very bad without oxygen mask, was still objectionable when mask was worn inside the helmet as shown in these Soviet pictures.

Although the Russian suit is full pressure, it is difficult to say whether it is partly a mechanical pressure suit as USAF's suit, where bladders press suit against the skin or an air pressure suit as in Navy's Goodrich and Arrowhead garments where air between skin of the suit and man's body exerts the pressure on the skin.

Way the Russian suit fastens together up the front of the torso indicates that what is visible is an outer garment with a pressure shell underneath.

Arrowhead suit uses one ball bearing race where helmet attaches to the suit, has bellows for elbow, waist and knee joints. Goodrich uses five ball bearing joints which appear to be used at neck, armpits and elbows. Suits now under development cut ball bearing races to one at the neck.

Russian suits seem to avoid the ball bearing problem.

Inner helmet of U.S. suits give adequate crash protection for the head, unlike Russian suits shown in these pictures.

Soviet high altitude helmet, shown in this photograph obtained by AVIATION WEEK, is very similar to the USAF type MB-5, now a limited standard helmet in this country. Visual area of Russian model is very good and is superior to the MB-5, but is not equal to current Air Force helmets under development.

Existence of this equipment implies use of aircraft with operational altitude capabilities of 50,000 ft. or more and a good understanding of the physiological requirements involved. With an adequate pressure suit, the helmet would provide physiological protection to unlimited altitude. Time-at-altitude limitation cannot be estimated from the photograph of the helmet alone.

The Soviet helmet appears to be a full pressure unit which probably seals at the neck. This is evidenced by such features as a tie-down cable assembly to prevent it from being lifted upward, and a lack of oral-nasal mask or face seal. The oxygen inlet hose indicates that a pressure-demand breathing system is probably used.

Helmet's visor is probably removable. No microphone is visible.

Weight of the helmet is probably about five pounds. It is not equipped with quick-donning provisions and probably requires a minute or longer to put on with trained assistance.

In the picture, the pilot is wearing some sort of suit under his leather jacket as evidenced by the closed zipper and heavy-duty slider. However, this does not appear to be a full pressure suit because of the lack of bulk in the shoulder area. More probably, it is some type of emergency suit such as a partial-pressure or bladder-type suit.

USAF Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Air Force Contracting Offices:

SAN ANTONIO R&D PROCUREMENT OFFICE, ARDC, Lackland AFB, San Antonio, Tex.

Research Center of Borg-Warner Corp., Des Plaines, Ill., research and development on the use of remote manipulators in maintenance of nuclear-powered aircraft. (Contract AF 41 (657-180), $99,222.

WARNER ROBINS AIR MATERIEL AREA, USAF, Robins AFB, Ga.

Cox and Stevens Electronic Scales Div. Revere Corp. of America, 845 N. Colony Rd, Wallingford, Conn. Kit, electric, aircraft weighing (IFB-418) 14 ea. $44,878.

United Truck & Equipment Co., Inc., 1242 S. Paca St., Baltimore 30, Md. Weighing kit, vehicle, type MA-1 (RFP-1140) 52 ea. $404,311.

Walter Kidde & Co., 675 Main St., Belleville, N. J. Spare parts 50 cal. gun charger system (PR-675059) $78,243.

Glenn L. Martin Co., Baltimore, Md. Engineering, prototype installation, spare parts, tooling, testing applicable to B-57 aircraft (PR-735101) $1,195,310.

Motorola Inc., 2710 N. Clybourn Ave., Chicago 14, Ill. Modification kits applicable to APS-23 & APS-64 (PR-704537) 2 contracts $93,690 & $146,907.

Davey Compressor Co., Kent, Ohio. Compressor, gas engine driven, 15 CFM, 200 PSI (IFB-331) 1,293 ea. $1,615,541.

Philco Corp., 4700 Wissahicon Ave., Philadelphia 44, Pa. Modification & repair of RT-324/APS-64 (PR-734600) $864,798.

Motorola, Inc., 2710 No. Clybourn Ave.,

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Chicago 14, Ill. Repair & modification of AN/APS-23 & APS-64 components (PR-734552) $819,243.

Leonard Precision Products Co., 9200 Bolsa Ave., Santa Ana, Calif. Machine-flaring tube, double lap (RFP-1145) 22 ea. $54,479.

General Electric Co., Johnson City, N. Y. Spare parts applicable to A-5, MD & C Series bomber FCS $44,404.

Crosley Div., Avco Mfg. Corp., 1329 Arlington St., Cincinnati 25, Ohio. Servo assys. applicable to B-52 aircraft (PR-739254) $46,394.

Crosley Div., Avco Mfg. Corp., 1329 Arlington Ave., Cincinnati 25, Ohio. Spare parts applicable to A-5, MD & C series Bomber FCS $27,458.

Hughes Aircraft Co., Culver City, Calif. Services & supplies for repair & modification of Hughes designed FCS components and assemblies (PR-735246) $2,865,319.

Stromberg-Carlson Div., 1700 University Ave., Rochester 10, N. Y. Replacement of KH type sealed amplifier kits (PR-693470) $384,145.

Navy Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, 700 Robbins Avenue Philadelphia 11, Pa.

Irving Air Chute Co., Inc., 1315 Versailles Rd., Lexington, Ky., Parachute Assy; (IFB 383-1894-57) $228,931.

Sperry Gyroscope Co., Sperry-Rand Corp., Great Neck, L. I., N. Y. Transformer & Techometer Assys, Air Compressors (PREN-11-4710/56) $29,150.

Red Bank Division, Bendix Aviation Corp., Eatontown, N. J. Generators (383/2140-22/55) 132 ea. $26,884.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill. Magnetic Inspection Units (JD-IFB-383-1723-57) 16 ea $50,320.

Hamilton Standard Division, United Aircraft Corp., Windsor Locks, Conn. Parts & Services for controls (383/23055-44P6/57, 383/2118-5019/55) $153,225.

Bulova Watch Co., Inc., Bulova Park, Flushing 70, N. Y. Testers & Publications (383/29067-383, 56/57) $415,185.

Mine Safety Appliance Co., 201 N. Braddock Ave., Pittsburgh 8, Pa. Testers (IFB 383-1805-57) 71 ea $26,077.

Western Electrical Instrument Corp., 101 N. 33rd St., Philadelphia 4, Pa. Voltmeters (IFB 383-1907-57) 173 ea $35,339.

New Hampshire Ball Bearings, Inc., 20 Grove St., Peterborough, N. H., ball bearings, N163-5456 (9150B), $31,568.

BUREAU OF SHIPS, Washington 25, D. C.

Walker Electrical Co., Inc., 70 Bennett St., N. W., Atlanta, Ga., switchboard, Terrier guided missile, contract NObsr-73615 (Inv. No. 565-747Q) 3 ea., $141,512.

General Electric Co., Court St., Syracuse, N. Y., design, develop and furnish countermeasures parallel traveling wave tube jamming transmitter, Contract NObsr-72678 (Inv. 841-76040Q3) 1 ea. $187,891.

NAVAL AVIONICS FACILITY, Indianapolis 18, Ind.

General Electric Co., 2800 Far Hills Ave., Dayton, Ohio, capacitors, spec. MIL-C-3965, N163-5466 (110990), $25,900.

Gamewell Co., 128 Chestnut St., Newton Upper Falls, Mass., potentiometers, N163-5421 (9854 (A) B), $46,308.

New Hampshire Ball Bearings, Inc., 20 Grove St., Peterborough, N. H., ball bearings, N163-5456 (9150B), $31,568.

Helipot Corp., Div. of Beckman Instruments, Inc., P. O. Box 458, Newport Beach, Calif., potentiometers, N163-5224 (5969-57B) 288 ea., $30,326.

BUREAU OF ORDNANCE, Wash., 25, D. C.

Lehigh Chemical Co., Chestertown, Md. Aircraft ordnance, all-weather, semi-fluid lubricant, SNSN J941-L-4025, MOrd-17745, Prop. No. 226-57 10,000 lbs. $65,090.

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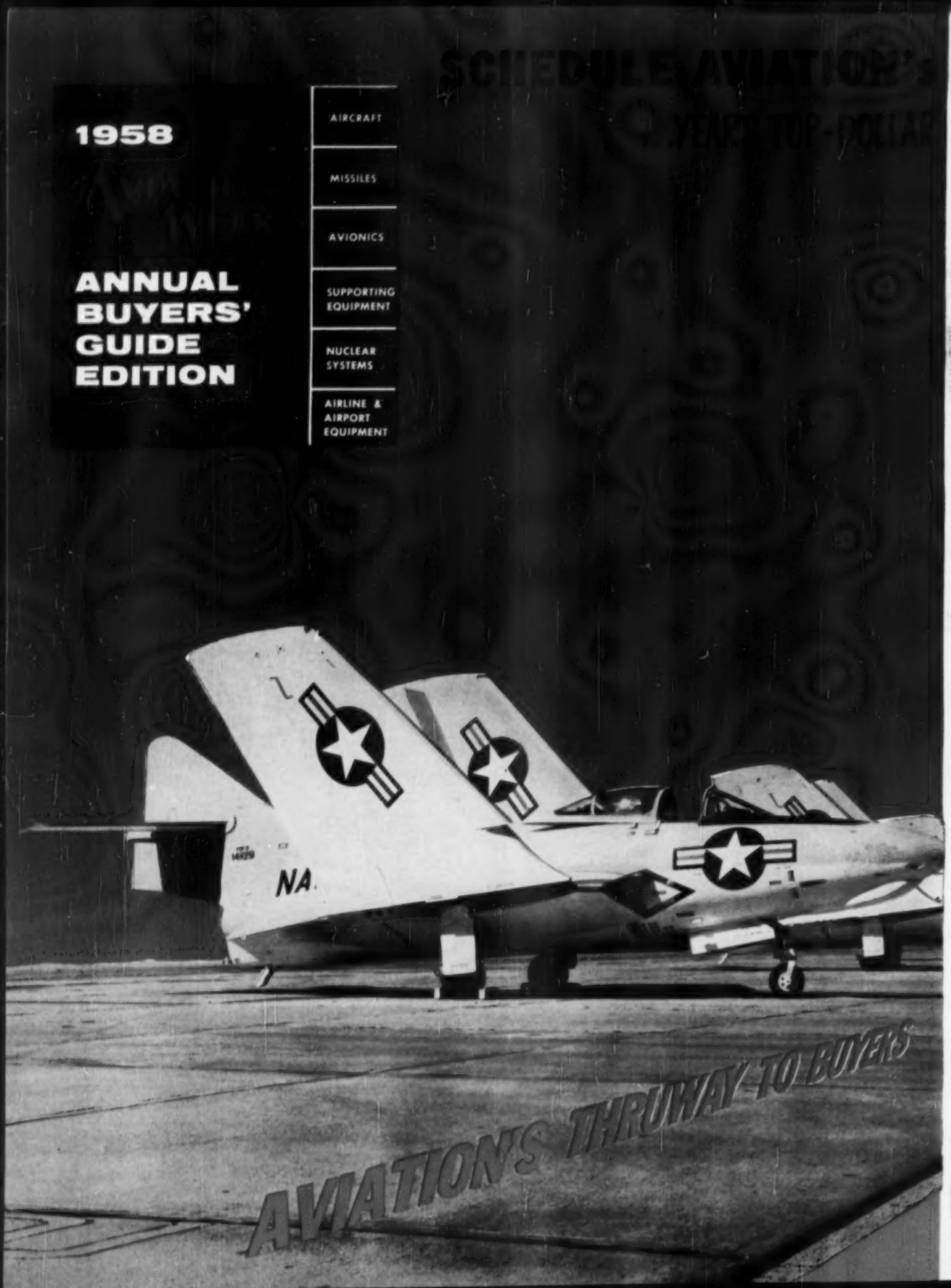

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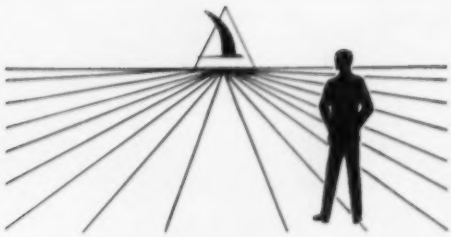

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WHO'S WHERE

(Continued from page 23)

Changes

Charles J. O'Donnell, general manager, Reconnaissance Systems Division, Fairchild Camera and Instrument Corp., Syosset, N. Y.

Robert A. Wolf, head-systems requirements department, and **Dr. David A. Kahn**, head-systems synthesis department, Systems Research Division, Cornell Aeronautical Laboratory, Buffalo, N. Y. Also: **Maurice M. Kaushagen**, head-electronics department; **Walter P. Targoff**, head-servo mechanics; and **King D. Bird**, head-transonic tunnel department.

Frank M. Salisbury, chief engineer, Carmody Corp., Buffalo, N. Y. Also: **Dr. William D. Lybrand**, director, newly established training department.

Siegfried Holzbaur, engine sales representative for western Europe (Stuttgart, Germany), Lycoming Division, Avco Manufacturing Corp., Stratford, Conn.

George C. Prill, manager-European sales office (Geneva, Switzerland), Convair, division of General Dynamics Corp., San Diego, Calif. Mr. Prill will be assisted by **Rolf D. Cape, Philip Ward** and **Theodore Laven.**

I. M. Berry, general manager, San Fernando Electric Manufacturing Co., San Fernando, Calif.

Roy C. Irick, head-applications engineering, Pacific Semiconductors, Inc., Culver City, Calif.

H. N. Beveridge, manager-Electronics Department, Aerophysics Development Corp., subsidiary of Curtiss-Wright Corp., Santa Barbara, Calif. Also: **Herbert H. Halperin**, weapons system support project engineer, Aerophysics Development Corp.

Charles C. Neighbors, Jr., coordinator-advertising and public relations, Greer Hydraulics, Inc., Jamaica, N. Y.

Gordon Israel, chief engineer, PacAero Engineering Corp., Santa Monica, Calif.

Stanley J. Mannette, assistant to the manager of Aviation Sales, Cities Service Petroleum, Inc., New York, N. Y.

John Burke O'Donoghue, field sales manager, Cleveland Pneumatic Tool Co., Cleveland, Ohio.

Edward Wolf, manager-special products department, Aviation Products Division, Goodyear Tire and Rubber Co., Akron, Ohio.

Merle E. Snyder, manager, Electronics Division, Atlas Precision Products Co., Philadelphia, Pa.

Leonard I. Kent, chief microwave engineer, The Narda Microwave Corp., Mineola, N. Y.

Howard S. Gleason, assistant general manager, Electronics Division, Stromberg-Carlson, division of General Dynamics Corp., Rochester, N. Y.

Cliff N. Williamson, chief engineer, Central Engineering Division, Airpax Products Co., Middle River, Md.

William N. Hall, manager-St. Augustine, Fla., branch plant, Fairchild Aircraft Division, Fairchild Engine & Airplane Corp., Hagerstown, Md.

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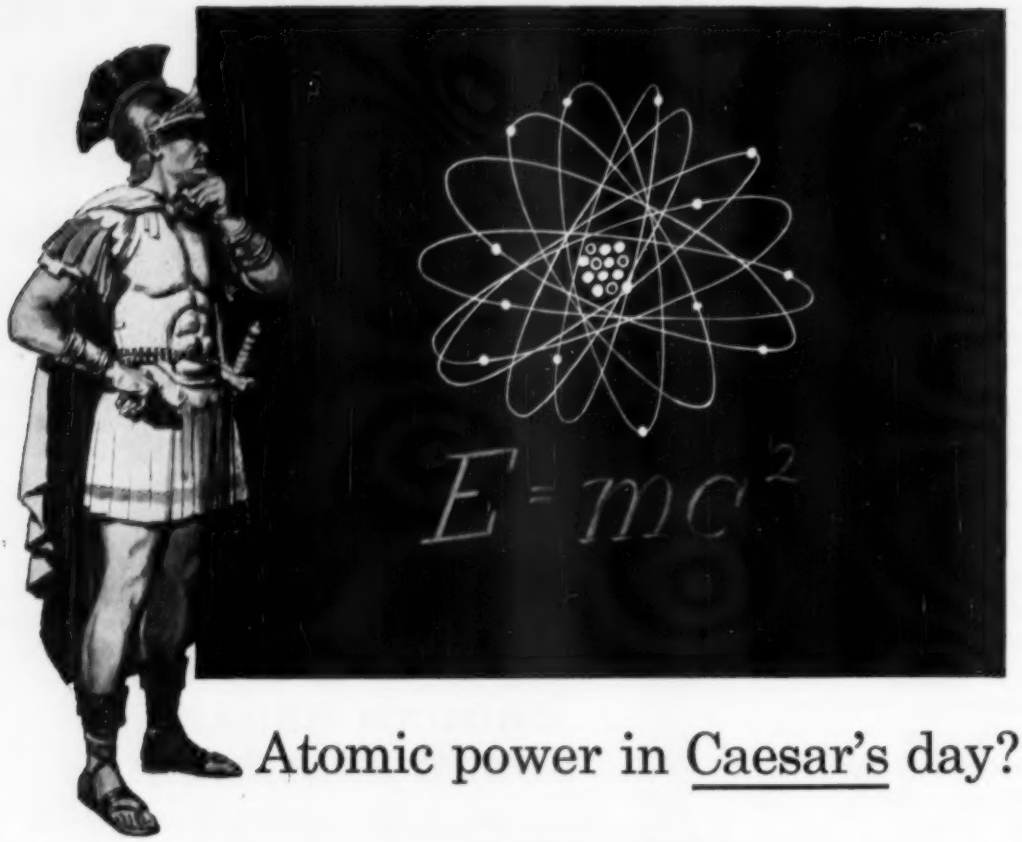

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LETTERS

Magnathorium Use

We read with interest the statement on p. 23, AVIATION WEEK, May 20, concerning magnathorium as a possible successor to titanium in the high temperature field. While this represents a commendable improvement in magnesium alloys, we feel the statement is somewhat misleading. The following tabulation compares the properties of magnathorium and titanium:

ALLOY	DENSITY lb/in³	UTS, psi. R.T.	UTS, psi. 600°F	UTS/DENSITY ×10⁶ R.T.	UTS/DENSITY ×10⁶ 600°F
HK31*	.07	34,000	13,000	4.9	1.9
MST Grade III†	.164	90,000	42,000	5.5	2.6
MST 6A1-4V†	.161	150,000	110,000	9.3	6.8
MST 6A1-4V*	.161	180,000	140,000	11.2	8.7

* Age hardened
† Annealed

Even considering only the commercially pure titanium (MST Grade III), titanium has greater strength at room temperature and at 600°F than does magnathorium.

The comparison based on the density of the two materials still is favorable to titanium. If one considers commercial titanium alloys, their strengths may exceed those of magnathorium by 5 to 10.

DILLON EVERS
Manager of Research
Mallory-Sharon Titanium Corp.
Niles, Ohio

Sabre Echoes

Congratulations on a fine editorial, "Salute to the Sabre," which appeared in the July 15 issue. Probably no other airplane in recent years has captured the imagination and affection of so many. For it's performance in Korea our country should be truly grateful.

Aside from mere beauty of lines, the craft is a remarkable fighting design which is further enhanced by the natural extension of its capabilities to the Super series, and the excellent FJ series which we are now producing for the Navy.

Just as the Sabre series out performed all comers in the Air Force in its day, the FJ-4 outdoes its sister airplanes which wear the white and grey, taking back talk only from airplanes which are not yet operational. The excellence of the design is further brought home to observers when they note that such highly touted designs as the A4D turn in rather homely performance records when stacked up against the Fury four.

However, we cannot rest on our laurels and we are doing anything but that at North American, Columbus. Our competitors will take little comfort in the accomplishments of their organizations in the near future, for a new breed is coming to place them again in their natural position of "trail" in the industry. Even as our competitors struggle to get their first supersonic designs operational the new breed is being born, and instead of being five years behind North American they will find themselves eight and even ten years behind, depending on whether you are in Bethpage, St. Louis, Dallas, Ft. Worth, San Diego, Los Angeles, or Seattle.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address Letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

As an example, we read in the journals that the B-58 is the fastest bomber in the world and is so sophisticated that it's better than beer. Actually it is as sophisticated as a wagon wheel. I'll bet that the run-in speed of the Hustler with that monstrosity hanging outdoors is a sedate 1.5 Mach number, with a respectable 1.8 or 1.9 available for the run-out. In this case it's like Esther Williams. Clean she's a star, dirty she ain't. Imagine building a beautiful airplane like that and then hanging that gadget under the belly. As for the claim to the fastest bomber in the world, that will be enjoyed only for a short time in Ft. Worth, for it's coming home to NAA where it belongs. My advice to those in that community is sell your stock and buy North American, for soon the sophistry (sic) of the dedicated and truly enlightened preliminary design group at Columbus will take to the air for the Navy. Here will be the true example of sophistication.

In the not too distant future, when a startled engineer at Ft. Worth rushes out of the plant and regards the building as it leans slightly to the west, he might take the time in his excitement to note that the list to port was caused by that A3J which just passed on its way to a history with the fleet that will one day cause another fine editorial to be written in AVIATION WEEK.

HOWARD L. MOXHAM
NAA Field Service Representative
Kingsville, Tex.

Specht Fact 'Omission'

Reference the letter to the Editor "ALPA Defends Specht" (AW July 29, p. 118), Mr. Sayen, president of the Air Line Pilots Assn., appears obviously to omit some of the facts he states are so important.

Anyone reading the transcript of the two way radio conversation between Capt. Specht and the CAA controller can clearly see that nowhere in the conversation did Capt. Specht say he was declaring an emergency due to icing conditions. He doesn't state anytime during the conversation what the nature of his emergency is. Furthermore, the transcript shows that Capt. Specht did not mention an emergency until the controller asked him if he had a special reason for vacating his altitude. Then, Capt. Specht advised, "I'm going to declare an emergency."

The transcript clearly portrays the attitude of Capt. Specht in the following quotes from the transcript: (TWA to controller), "Get 16,000 out of the way then. In the first place we were out of LaGuardia first ahead of that traffic and that was our requested altitude and we should have it." Also, "We're leaving 14,000 in about three minutes, you get him (Capital Airlines Flight 31) out of the way." And, "You get that traffic out of 16,000. I'm going up there."

None of these could be considered a normal request for a change of altitude, particularly since no mention of an emergency had been made up to this point.

It was apparent during the hearing that counsel for Capt. Specht abandoned all proper procedure of examination to cross examine the CAA controllers as if they were hostile, adverse witnesses in a criminal prosecution. The controllers were not treated with consideration to which witnesses are entitled—who earnestly try to present objectively and impartially the facts about which they are questioned. This was even protested to the ALPA by the Air Traffic Control Assn. It appears that Mr. Sayen and the ALPA are defending "their man" to the last ditch, regardless of whether he was right or wrong.

I wonder if Mr. Sayen would not be a little more cautious of his criticism of the CAA controllers if he had been the captain of the Capital airliner whose altitude Capt. Specht climbed through without clearance. Shouldn't the fact that the Capital airliner was jeopardized be considered, or doesn't the Capital pilot belong to the ALPA?

I believe Mr. Sayen was in error when he states, "The ATC controllers did absolutely nothing to protect Capt. Specht in his emergency, to warn the aircraft above him or to otherwise perform their required duties under the circumstances." The facts clearly show just the opposite. The controller was performing his duties by not approving Capt. Specht's climb through the altitude of another aircraft when there was not proper separation, as required by CAA regulations. The facts prove that the aircraft passed in close proximity to each other during the unauthorized climb by Capt. Specht, in fact, close enough that the Capital pilot saw Capt. Specht's aircraft as it went through his altitude.

I wonder if Mr. Sayen really believes that the CAA is condemning Capt. Specht because of an error he committed? Was it an error or was it an apparent violation of CAA regulations that prompted the action of the CAA?

Who is Mr. Sayen trying to kid? In my opinion, the hazard being created is not the one which he stated but the fact that he, as representative of the pilots of the airlines which we, as the public, fly on, is trying to pull the wool over the eyes of the public. . . .

CHARLES R. FIELDS
Richmond, Va.

CAA Inspectors

After reading ALPA President Sayen's letter (AW July 29, p. 118) regarding Capt. Specht's Airline Transport license being *arbitrarily* suspended by the investigating "Safety Agent:"

Why the misnomer "Safety Agent?" CAA "Safety Agents" always were and are Inspectors, and should be referred to as such.

E. D. WEINER
Los Angeles, Calif.

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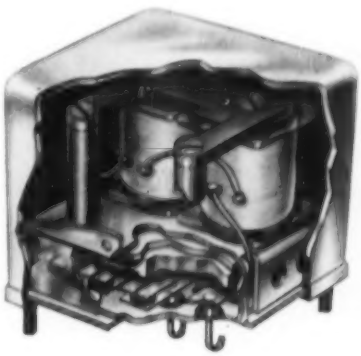

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